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APRIL 1959

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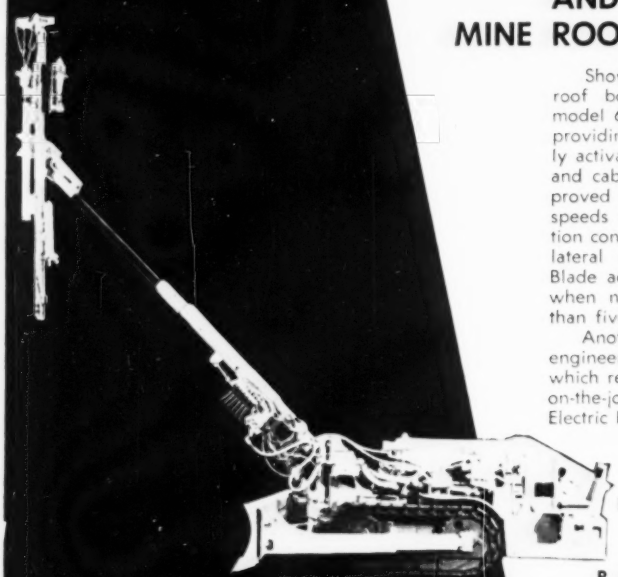

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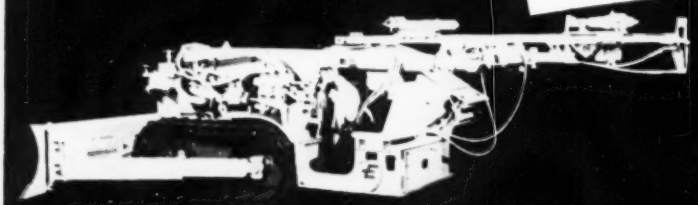

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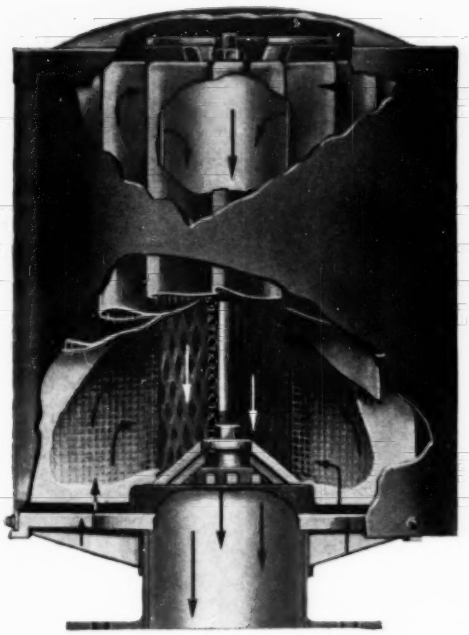

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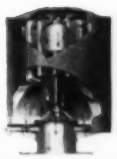

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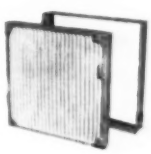

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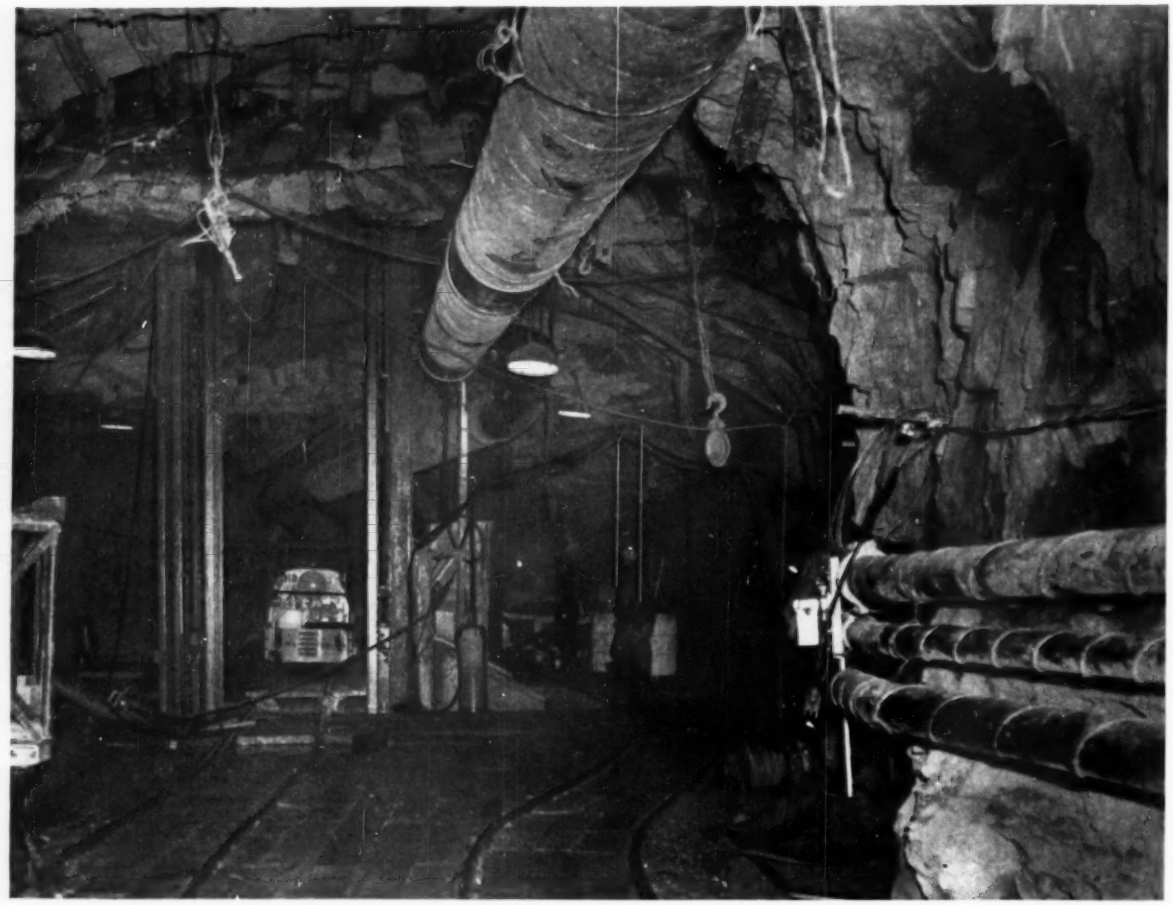

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Compressed Air Magazine

Founded 1896

VOLUME 64 NUMBER 4 **APRIL 1959**

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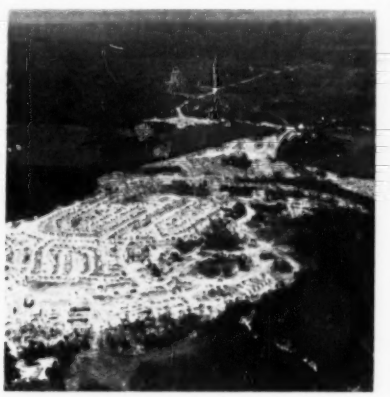

ON THE COVER

THIS aerial view shows a city under construction. Located in territory that less than 5 years ago was almost unbroken wilderness, it now has a population of 10,000. Elliot Lake, Ont., Canada, was built on a foundation of uranium, in itself a little known metal until the age of the atom. It is the human side of a $267 million investment in what is probably the world's largest uranium development. The story of that development begins in this issue. A great deal of the story has to do with the mass movement of about 25,000 people into the mining area and the development district of which Elliot Lake is a part. The over-all population of the district is expected to reach a total of 50,000 in years to come, depending on the future of uranium.

FEATURE ARTICLES

Page 12 **Algoma Uranium, Discovery And Development**—*R. C. Hart*
The uranium strike centered between Sudbury and Sault Ste. Marie in Ontario, Canada will surely go down in the annals of mining as one of the outstanding prospectors' and miners' stories of all time. A veteran of the staking party that opened the area tells of the discovery and development of the now famous field.

18 **A Revitalized Air Plant**—*R. J. Nemmers*
After World War II, Remington Arms Company initiated a full-scale program to convert from the manufacture of war ammunition and weapons to its peacetime task of supplying the nation's sportsmen. The modernizing steps taken in conjunction with the program included the firm's air plant.

22 **Refueling Jet Aircraft—A Compound Problem**
To keep the many types of jet aircraft in the sky, a system of rapid ground refueling was devised.

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One of the few facilities in the U. S. of a capacity to simulate flights below, through and beyond the speed of sound, the tunnel described uses 42 tons of high-pressure compressed air at a time.

28 **Compressed Air Fires Ice**
Ice, hitting turbocompressor blades at a velocity of 675 feet per second, brings factors incurred in jet travel to the laboratory.

30 **Pneumatic Positioning**
Positive, well-cushioned positioning of wooden panels is accurately achieved with air power.

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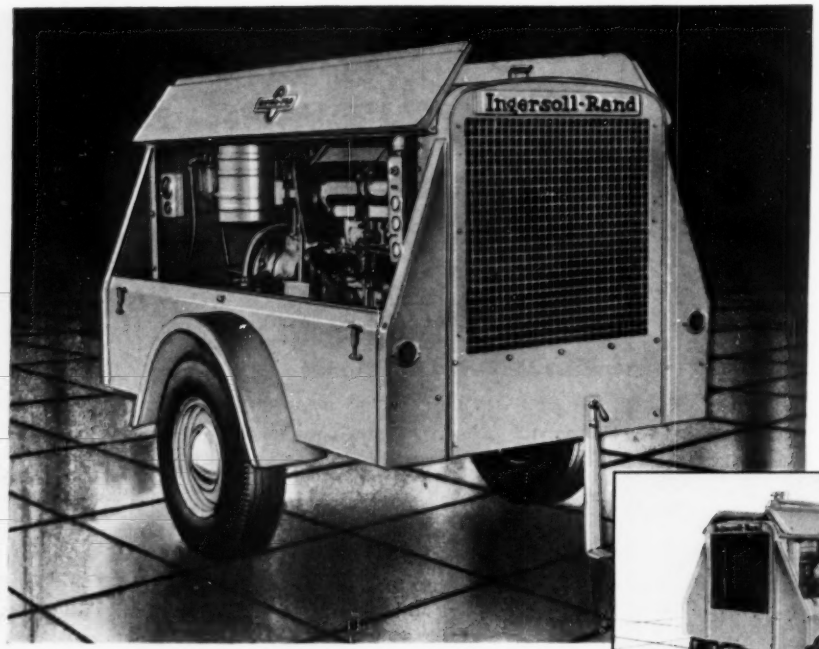

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FOR MORE INFORMATION on quiet running G-E motors and control for part-winding starting, call your nearby Apparatus Sales Office or distributor, or mail coupon for free bulletin, General Electric Co., Schenectady, N. Y.

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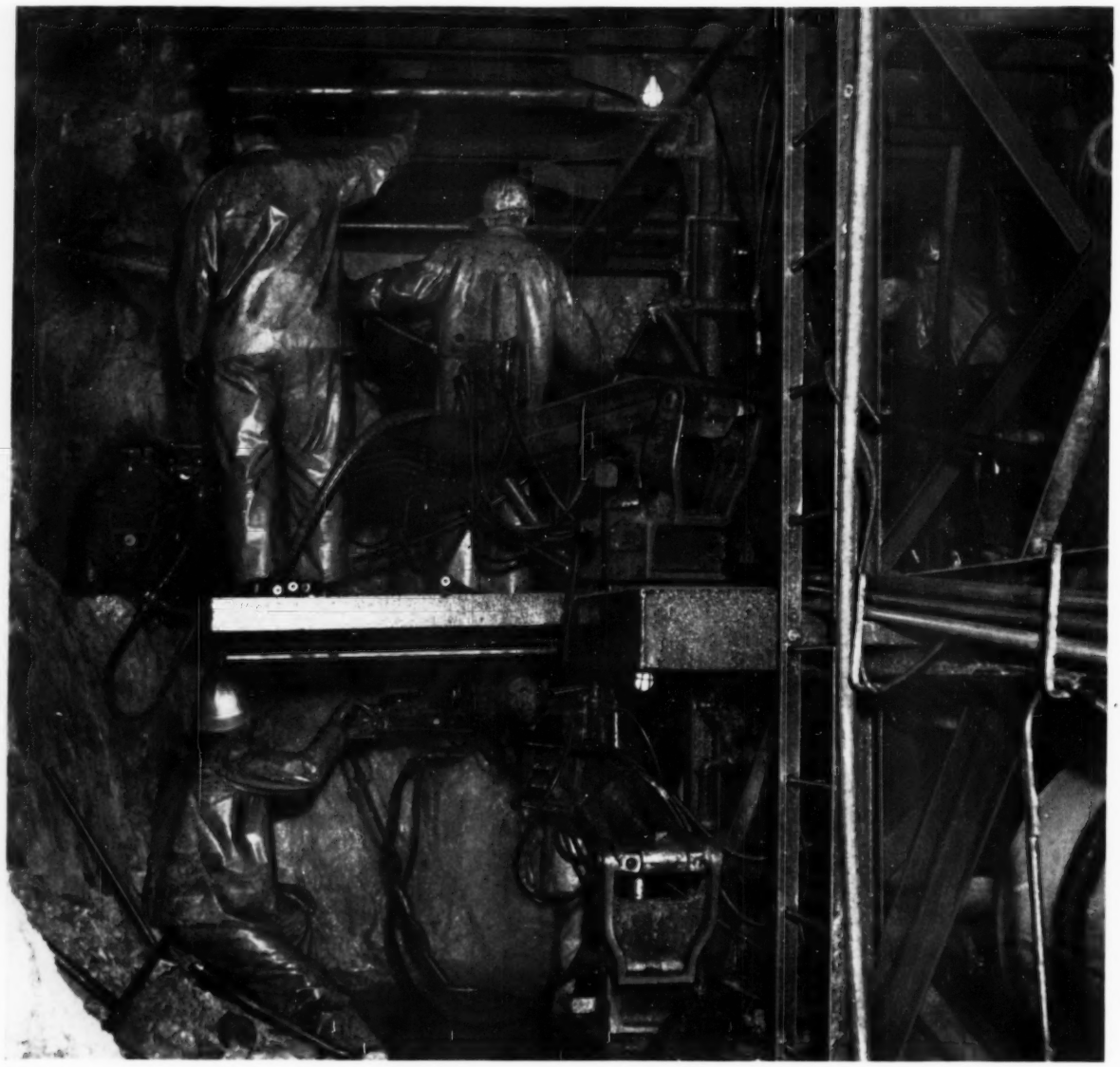

Steel Bites Granite at Fremont Canyon

Using Bethlehem Hollow Drill Steel to bore most of the blast holes, the contractors are making steady progress in removing 225,000 cu yd of rock, most of it granite. The scene: Fremont Canyon Power Plant and Power Conduit Project in Wyoming.

Authorized by the Missouri River Basin-Glendo Dam Unit of the U. S. Bureau of Reclamation, the project is about 40 miles southwest of Casper. Besides driving two 3-mile tunnels the contractor is excavating for the power house. Said W. W. Roberts, superintendent for the Coker-Kiewit-Cunningham combine: "Bethlehem Hollow is providing good service on this job. We like it."

You can count on good service in any type of rock with Bethlehem Hollow. Rolled from a special fatigue-resistant steel, it has a uniformly round hole. Easy to heat-treat, it has a wide quenching range.

Bethlehem Hollow comes in Carbon and Ultra-Alloy grades, in all standard sections and lengths. Make sure you have Bethlehem Hollow on your next rock removal job.

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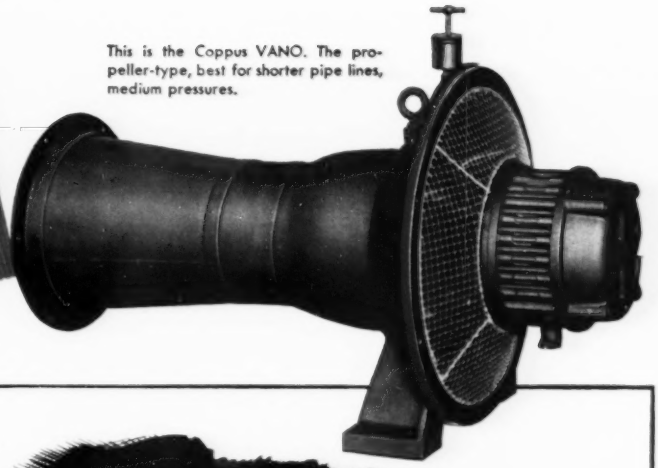

This is the Coppus VANO. The propeller-type, best for shorter pipe lines, medium pressures.

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These are the cost-reducing Blowers that give up to 100% more air

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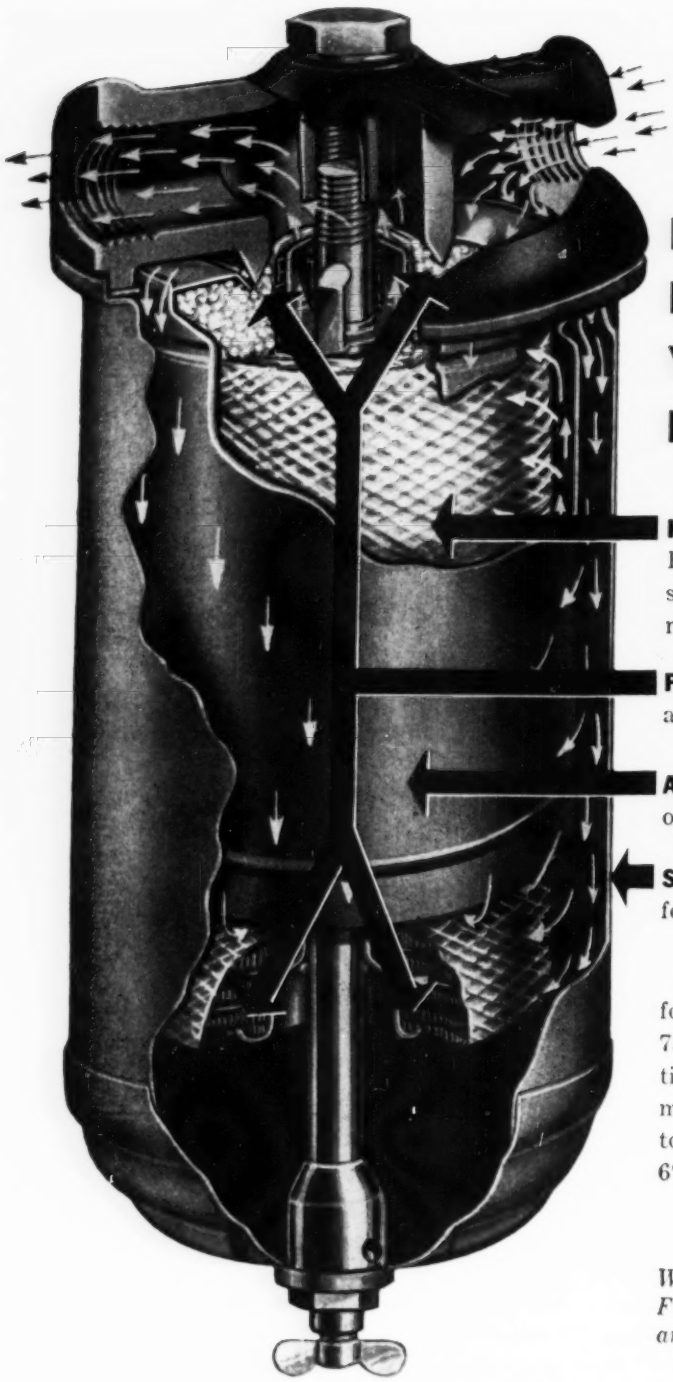

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HONEYCOMB FILTER TUBE: Patented Honeycomb Filter Tubes minimize troublesome gumming — remove moisture, oil, microscopic dust, rust, dirt and scale.

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Here's compact, versatile straight-line power. Just look at the features!

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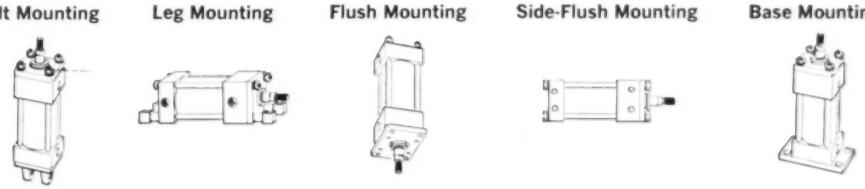

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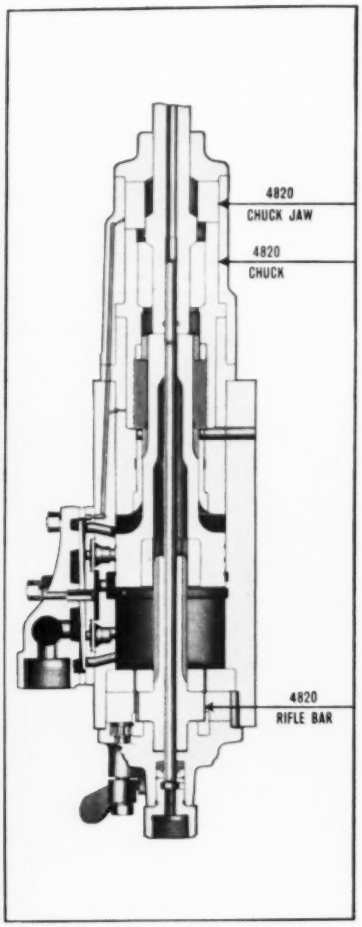

Self-propelled blast hole drill in operation on a road construction job. Drill is a 4½" bore heavy duty unit; uses Type 4820 nickel alloy steel parts. Product of Ingersoll-Rand Corp., 11 Broadway, New York 4, N. Y.

New self-propelled blast hole drill uses nickel steel parts for high power capacity

...Type 4820 nickel steel provides high strength plus wear resistance

To insure rugged dependability in its versatile new Crawl-ir self-propelled blast hole drill, Ingersoll-Rand puts high-performance nickel-molybdenum alloy steel – type 4820 – into stressed drill head parts. (See cutaway drawing.) To give you a brief idea of its properties . . .

Type 4820 nickel alloy carburizing steel (0.19% C, oil quenched) averages 195,000 psi tensile, 160,000 psi yield strengths, with high Brinell surface hardness. Case and core properties can be closely controlled by selecting rates and temperatures of box cooling, reheating, quenching and drawing.

Nickel steel parts contribute mightily to this drill's dependability – provide the combination of wear resistance, impact and tensile strengths needed for long service. This steel is freely available from steel producers and service centers across the country.

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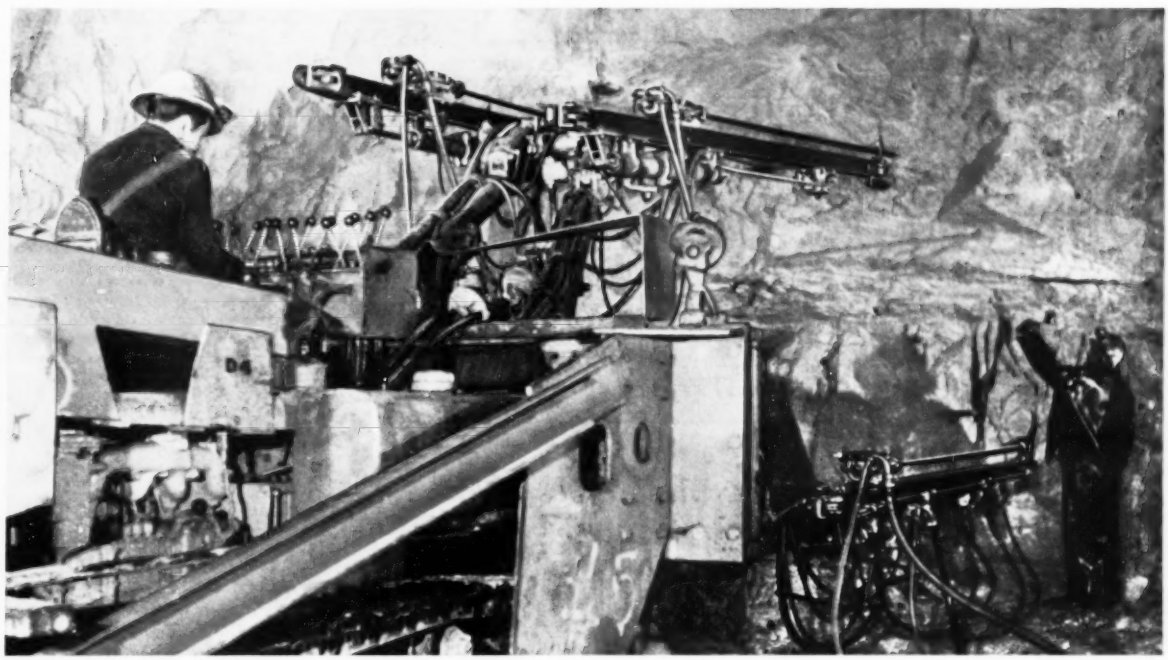
speed underground drilling in Canada's URANIUM MINING BOOM



Unlike the gold rush of Klondike days, the uranium boom in Canada's Algoma Elliot Lake area is spearheaded by the most efficient *mechanized* equipment. To speed up drilling with minimum effort, the Panel Mine of Northspan Uranium Mines Ltd. is using four Ingersoll-Rand Hydra-Boom drilling rigs, one of which is shown above, operating 1700 feet below the surface.

Each tractor-mounted rig carries three heavy-duty I-R drifter drills mounted on Ingersoll-Rand Hydra-Booms, providing smooth effortless hydraulic control of all drill motions. Booms are raised or lowered and swung from side to side and drill guides are extended, retracted, dumped and swung at the touch of a throttle – all drills easily controlled by one rig operator. Using $1\frac{1}{8}$" round steel and $1\frac{3}{4}$" tungsten carbide insert bits, these rigs are used in a room and pillar trackless mining operation, teamed with 48" ramps mounting 30-hp I-R slusher hoists.

I-R Hydra-Booms represent the last word in *mechanized* rock drilling—convert setup time into drilling time and increase production by as much as two-to-one. Rugged, versatile and easy to operate, Hydra-Booms are designed and built to withstand the punishment and abuse inherent in underground mining operations. Swing and lift cylinders are double acting, fast moving, and locked to prevent dropping the boom if hydraulic lines are broken.

Ask your Ingersoll-Rand drilling engineer for complete, cost-saving facts about I-R Hydra-Booms. Or send for a copy of new bulletin 4196.

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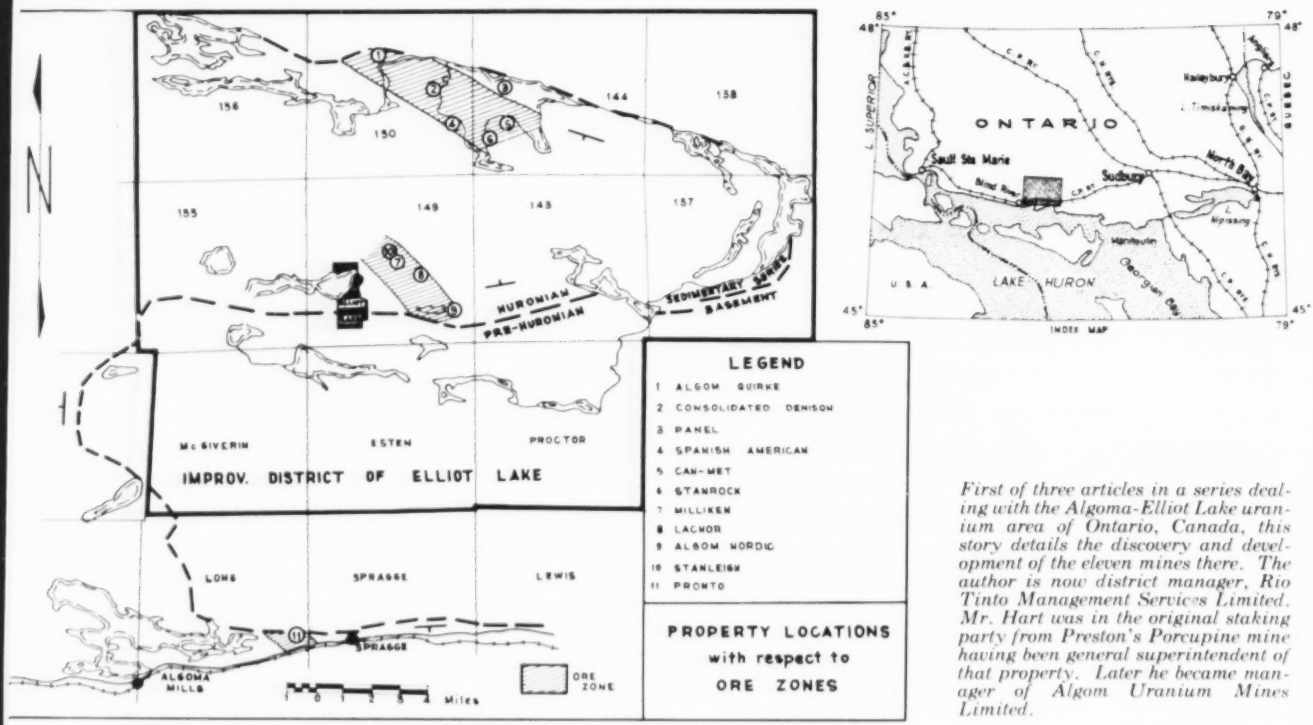
A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK



First of three articles in a series dealing with the Algoma-Elliot Lake uranium area of Ontario, Canada, this story details the discovery and development of the eleven mines there. The author is now district manager, Rio Tinto Management Services Limited. Mr. Hart was in the original staking party from Preston's Porcupine mine having been general superintendent of that property. Later he became manager of Algom Uranium Mines Limited.

ALGOMA URANIUM

DISCOVERY DEVELOPMENT

R. C. Hart

THE ALGOMA uranium area of Ontario, and its focal point, the new community of Elliot Lake, are phenomena of the nuclear age.

The development is partially superimposed on rail and road services established many years ago between Sudbury and Sault Ste. Marie, as well as intervening communities. To a great extent, it has been built in virgin territory.

The country along the North Shore of Lake Huron within which the uranium deposits were found has been settled for nearly a century. During the course of the years much of the forest wealth has been harvested, considerable farming has been undertaken in the narrow, discontinuous strip of good soil near the lake front, and some mining has been done on the hundreds of copper-gold prospects in the rugged country north of the farms.

Following relaxation of restrictions on private initiative on prospecting for uranium in Canada, an army of searchers armed with Geiger counters re-examined many Canadian mines and prospects including the Algoma area. In 1949, one pair of prospectors examined samples in the office of the Mining Recorder at Sault Ste. Marie, and found one specimen labeled Long Township that was highly radioactive. Diligent search by these two men eventually located the long-forgotten shallow pits.

Franc R. Joubin, working independently as a consulting geologist at that time, was approached by the prospectors and became very interested in the deposit. His attempts to interest others over the next 2 to 3 years were unsuccessful due to a peculiar anomaly; although highly radioactive, no more than trace uranium or thorium assays could be obtained from the leached outcrop.

Dr. C. F. Davidson, then Chief Geologist of the United Kingdom Atomic Energy Authority, suggested to Joubin a possible answer to the problem. He recalled that elsewhere the leaching of pyritic deposits by surface water had removed uranium oxide, leaving as the only hint on surface, the emanation of radioactive radon gas.

While this investigation was proceeding, the original prospectors had dropped their claims.

Joubin then interested J. H. Hirshhorn in putting up capital to restake the claims and try out the leaching theory by a shallow diamond drilling campaign. The success of this drilling sparked the next step in a fantastic development.

Geology

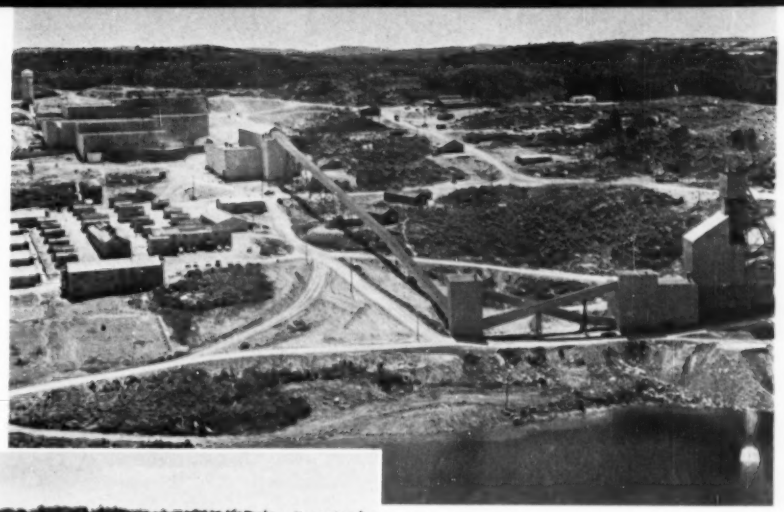
The rugged area immediately north of Lake Huron, in this part of Algoma, is underlain chiefly by sediments of Huronian age overlying the old Pre-Cambrian basement complex. The work of some members of the Geological Survey of Canada had been directed for many years to correlating these sediments with iron deposits of Minnesota and Michipicoten, the copper-nickel deposits of Sudbury and the silver-cobalt deposits of Temiskaming, all of which appeared to be related.

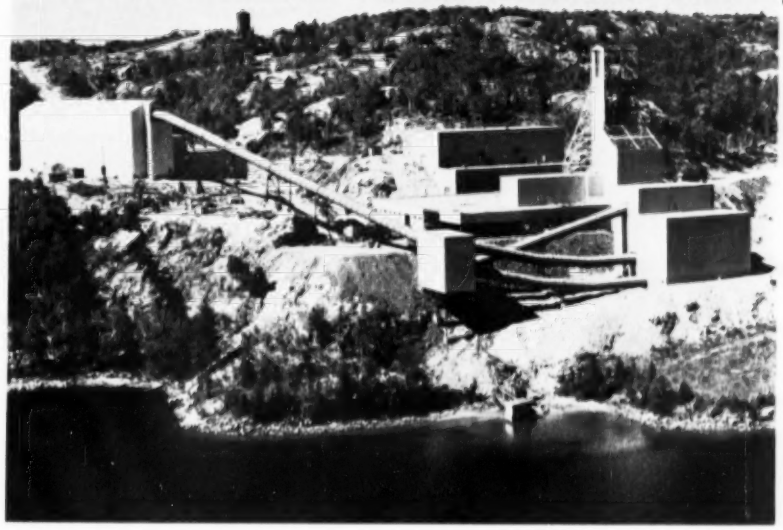
One of the many workers on this long-term project was Dr. W. H. Collins, for many years Chief of the Geological Survey of Canada. During 1914-16, he had chosen this part of Algoma as a typical area for detailed study and had published a map and report in 1922. Once this map had been resurrected, it was obvious the sediments in the "discovery" area extended for 80 miles to the north in a gently folded Z-shaped pattern.

The sediments in the radioactive pits in Long Township were quartz-pebble conglomerates lying close to the old Pre-Cambrian basement complex and overlain by quartzites. These conglomerates and quartzites were the pebble and sand beaches of 1800 million years ago that had been highly compressed and consolidated in their long history. The uranium-bearing horizons were gently dipping beds of quartz-pebble conglomerate. They carried from 3- to 15-percent pyrite, a uranium mineral finely dis-

CAN-MET

Can-Met Explorations Limited mines a deposit on the north limb of the main syncline. The ore is located at depths from 1500 feet in the north to more than 2000 feet in the south, near the two shafts which serve the mine. Both shafts intersect the orebody at 2085 feet, Number 1 being carried down to 2125 feet, and Number 2, to 2395 feet. Number 2 is the production shaft. The average thickness of the ore is about 15 feet. Consolidated Denison, bordering the mine on the west, has a controlling interest in Can-Met.





CONSOLIDATED DENISON

A main ore zone, 1500 feet deep on the north boundary and 3000 feet on the south, and located on the north limb of the main syncline is mined by Consolidated Denison. A 2-shaft system, with some production from both shafts at this time, the mine uses and has plans to use extensive underground belt conveyors for ore handling. Largest of the mines in the area, Dension's mill has a design capacity of 5700 tons per day. The main orebody consists of two beds separated by a pebbly quartzite 3 to 6 feet in thickness, the over-all zone averaging 16.7 feet in thickness. About 100 feet above the main orebody, a second, not continuous, ore bed occurs.

persed between the pebbles, and trace quantities of several other metals. Thorium was associated with the uranium mineral in the ratio of about four uranium to one thorium. Subsequently, microscopic study revealed that there were several uranium minerals present: brannerite, uraninite, pitchblende and a hydrocarbon thucholite.

Exploration

With the first returns in from diamond drilling, staking was again undertaken to enlarge the original property to the east and west, along the favorable contact area. At the same time, Collins' map was used to lay out a prospecting campaign along the Z-shaped structure to the north. This was too big a job for Joubin and Hirshhorn to undertake with their small exploration company, Technical Mine Consultants. Both were directors of Preston East Dome Mines Limited, a company operating a gold mine very successfully in the Porcupine area of Ontario, some 180 miles to the north. Thus, this company was immediately called upon to supply administration and personnel for the task.

Prospecting and staking in secret on a large scale so near to established communities was a problem to be faced. This was overcome by flying in personnel from the Porcupine area by "bush" aircraft. Within a matter of hours after the first prospecting crew commenced work, radioactivity was found, staking was started and continued along this favorable contact for 6 weeks with essentially no competition from other prospectors or mining companies.

About 75 men were involved in the staking, supplied entirely by aircraft that used the many lakes on or near the contact area. These men, during that time, staked more than 1100 claims or about 45,000 acres. Near the completion of this staking program, some outside prospectors began to appear on the scene, and immediately afterwards a rush developed that blanketed the entire area with some 8000 claims during the next few months.

Although it was many months before the value of the staking program could be estimated, it was eventually realized that the claims staked in Long Township by Technical Mine Consultants, and those staked by Preston East Dome on the limbs of the "Z" to the north, covered the surface outcrops of three huge orebodies with total estimated reserves of 500 million tons. This reserve is now being mined by eight companies in eleven plants with a capacity totaling 34,000 tons per day. The length of the orebodies varies from 5000 to 10,000 feet, and the thickness has an average of 14 feet.

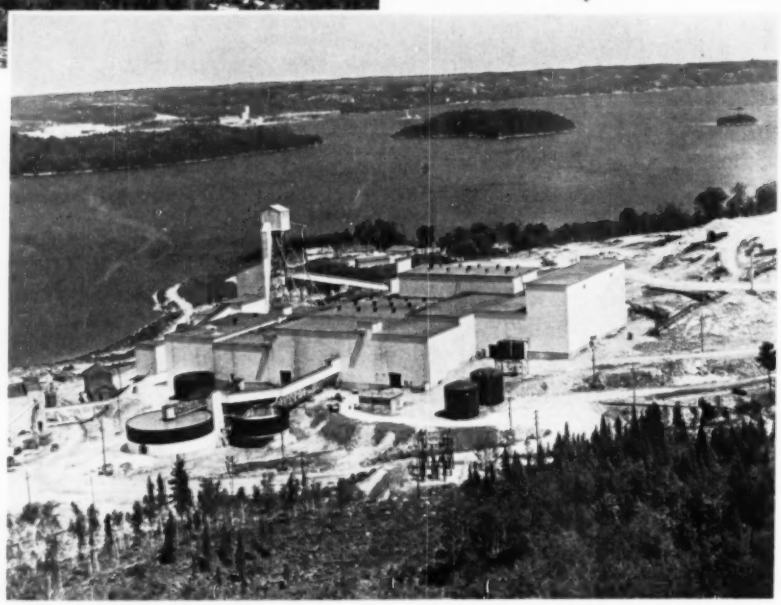
Pronto Uranium Mines Limited is mining the orebody developed from the original showing in Long Township on the south limb of the "Z"; Algom Uranium's Nordic and Quirke mines are mining, from surface down about 2000 feet, the two orebodies found on each limb of the "Z" to the north. Down-dip to the north from Algom-Nordic, Northspan Uranium's Lacnor mine is mining the same orebody from 2000 to about 2700 feet; Milliken Lake Uranium operating levels cover a range from 2300 to 3100 feet, and Stanleigh Uranium Mining Corporation is mining from about 3100 to below 3800 feet.

Down-dip to the south from Algom-Quirke, Denison and Can-Met are mining from about 1600 feet to the 2700-foot level; Northspan Panel is mining one flank from 1700 to 2700 feet; Northspan Spanish-American and Stanrock Uranium Mines Limited are mining the other long flank at depths of 2700 to 3500 feet.

All these mines are now in production.

SPANISH AMERICAN

Situated on the north limb of the main syncline, Spanish American ore deposits occur at depths from 2400 feet in the north to approximately 3500 feet in the south. Average thickness of the body is about 10 feet. Served by two shafts both intersecting the orebody at 3200 feet, the mine is the smallest of the so-called Northspan group. Its mill capacity is rated at 2000 tons per day. To enable the Northspan group to stay within its contracted rate of delivery, Spanish American was closed the first week in February. Underground equipment has been removed and the remainder of the mine and mill "mothballed" to await sufficient demand for uranium to assure economic operation. Improvements in methods and efficiency at the other two mines in the Northspan group—Panel and Lacnor—make it possible for the company to meet its contract requirements from just the two properties.



LACNOR

The Lacnor deposit is made up of two separate beds, each about 12 feet in thickness and separated by a barren quartzite, also approximately 12 feet thick. The ore zones lie 2350 feet below the surface on the south and 2750 feet on the north. The property is on the south limb of the main syncline. Two shafts serve the mine. Shaft 1 is 2761 feet deep crossing the ore bed at 2550 feet. Shaft 2 is 2720 feet deep and also crosses the ore at 2550 feet.

Pronto produced its first concentrate in October 1955; and the last mine to go into production, Spanish-American, shipped its first yellow cake in May 1958. In the interval between staking in May-July 1953, and final production, a tremendous change has occurred in the North Shore area.

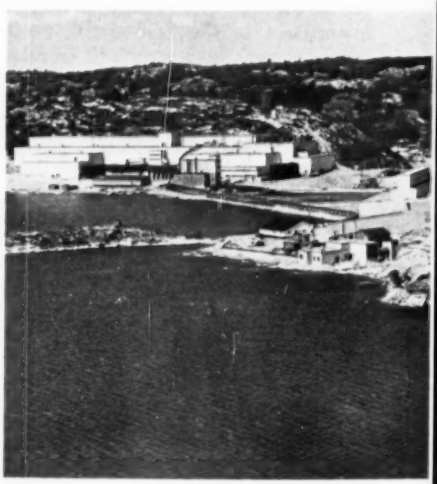
Financing

Preproduction problems were many, involving the raising of more than $325 million for mines and mine plants alone. Transportation and construction problems had to be solved in developing new mining camps, most of which were located 15 to 35 miles from rail and highway.

Many new names entered the field. The respected Rio Tinto Company Limited of the United Kingdom obtained management control of Algom Uranium in 1955, and a year later bought out the J. H. Hirshhorn interests in other companies, thus making it the leading uranium producer in the world. In the Elliot Lake area, Rio Tinto now controls Pronto Uranium, Algom, Northspan and Milliken, with a total daily mill capacity of 19,500 tons.

Consolidated Denison under the leadership of S. B. Roman bought a large block of claims tying on to the south of Algom-Quirke from Art Stollery, the original staker, and later obtained a controlling interest in Can-Met Explorations Limited for a total daily mill capacity of 9000 tons. Texas oil interests supplied much of the capital for Stanrock Uranium. American funds also contributed heavily in the establishment of Stanleigh Uranium Mining Corporation.

The basis for this investment by important financial and mining houses was the contracts negotiated by the mining companies with the buying agency of the Federal Government—Eldorado Mining & Refining Company Limited. In the Elliot Lake area, these contracts, that are based on repayment of debt plus a reasonable profit over a 5-year period, total more than $1.1 billion.



ALGOM NORDIC

Located on the south limb of the main syncline, the Algom Nordic orebody has an average thickness of 10.5 feet and a dip of 14 to 18 degrees to the north. On the southern boundary the ore is within 50 feet of the surface at the northern edge, 2000 feet. One shaft 890 feet in depth serves the mine. It crosses the orebody at 565 feet.

ALGOM QUIRKE

Located on the north limb of the main syncline, the Algom Quirke ore zone outcrops in the northern part of the property and reaches a depth of 1600 feet in the southern extremities. The ore dips from 25 to 34 degrees. Average thickness of the ore zone is 12 feet. The mine is served by one shaft, 861 feet in depth intersecting the orebody at 608 feet below the surface.

PANEL

The Panel mine is located on the north limb of the main syncline, the entire orebody being beneath Quirke Lake at depths ranging from 1100 feet on the north to 1700 feet on the south. Served by two shafts, one located on a small island in Quirke Lake, 1250 feet deep; and one on the shore of the lake, 1102 feet deep, the Panel deposits have an average thickness of about 12 feet.

Community Development

In June 1954, Algom Uranium took the lead in inviting departments of the Provincial Government to assess the development. From subsequent meetings, both on site and in Queen's Park, it was decided to set up a municipal structure known as an Improvement District. The status of an Improvement District is that of a township municipality established under order of the Ontario Municipal Board. In this case, it would include within its boundaries all mines developing the two northern orebodies and possible extensions in and around the Elliot Lake sedimentary basin encompassing an area of eleven townships, or 396 square miles.

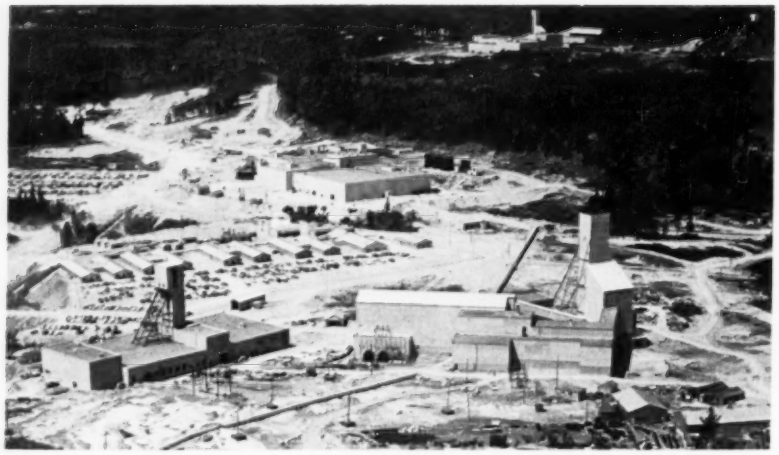
The purpose behind this move was two-fold:

- To insure that municipal growth would be confined to planned and well-designed communities with appropriate building and zoning by-laws.
- To insure that the mining operations, both present and foreseeable, would be within the municipal taxing range.

Thus, the Province made use of experience gained elsewhere in regard to a sound municipal structure, and the mining companies were relieved of the burden of developing individual townsites for their personnel.

An Administrative Subcommittee on Townsites had previously been appointed by the Cabinet to deal with such new projects in Ontario. This subcommittee, composed of representatives, at deputy minister level of the Provincial Departments of Mines, Lands & Forests, Municipal Affairs, and Planning & Development, authorized the Department of Planning & Development to proceed with a design for a centralized community in the Improvement District. It was to be known as Elliot Lake.

Preliminary plans were produced in early 1955 for the first phases of the community to be established. It was anticipated, at this point, that a population of 15,000 to 20,000 might be expected, and double this number, should all the mines that were under development be successful in obtaining contracts for their product. Since Algom Uranium Mines Limited was, by that time, well



MILLIKEN

Milliken Lake Uranium Mines Limited, now controlled by Rio Tinto, has an ore deposit on the south limb of the main syncline. The ore zone is at an average depth of 3000 feet and is served by two shafts, Number 1 bottoming at 3070 feet and Number 2, at 3400 feet. The deposits are from 10 to 12 feet in thickness.

advanced in construction of its two plants and the building up of its labor force, it again took the lead in residential building and initial services, using in part its own financial resources to trigger growth of the town-to-be.

A Trustee Board administers the Improvement District through Section 33 of the Department of Municipal Affairs Act; that is, all actions must have approval of the Department of Municipal Affairs. The Board is thus in the position of initiating projects as needs arise and of carrying out and enforcing approved policies and by-laws. Under a Trustee setup, the Board is automatically responsible for all municipal administration including schools, libraries, recreation, etc., in addition to normal municipal government.

Civic operations are carried on as in a normal municipality with departments of secretary, treasury, public works, assessment, fire and police reporting to the Board. The Boards of Health, Separate Schools and High Schools are separate entities.

A firm of consulting engineers has been employed for detailed design, calling of tenders (letting of bids) and supervision of work. The Public Works Department of the Municipality takes over when each project is accepted.

A paved highway (108), connecting on the south with Highway 17, provides a life line for transportation. Access roads feeding from Highway 108 to the various mines have been or are in the process of being reconstructed to Department of Highways' specifications.

A splendid commercial area has been constructed by private capital, which to date provides outlets for many types of retail businesses, banks, hotels, theaters and office space.

Two industrial areas have been developed that provide outlets for such services as oil and gas storage, vulcanizing shops, bit and drill steel shops, warehousing supply and construction companies, dairies, bottling works, etc.

Some 2000 residential lots and multiple dwelling sites have been serviced and for the most part have housing units erected upon them. Outside the central community, each mine has a small group of houses for key personnel and most have extensive quarters for employees still of single status.

One shortcoming of the initial planning has become evident; an underestimation of the number of family-unit trailers, or mobile homes, as they are called. Some 1700 of these units are now in the municipality: about 1200 are located in parks serviced by mining companies; 250 in parks serviced by the municipality; and the remainder, along highways and byways awaiting completion of additional parks. When located outside established and serviced parks, the trailers create health and sanitation problems of considerable magnitude.

Residential and commercial areas are fully serviced with sewer and water; some 20 miles of streets have been constructed and 16 miles paved. Installation of street lighting is in progress. The population is about 25,000, of which some 10,000 live in the community, 9000 to 9500 in trailer parks, and the remainder at camps operated by the mines or on construction projects.

The first school opened in September 1955. Three years later in September 1958, there were seven elementary schools, one high school and two schools under construction. There were more than 3000 children in elementary schools and 400 in the high school. This represents an average increase of some 100 pupils per month for the 3 school years; this trend shows no sign of slackening. The mining companies now employ more than 10,000. This would indicate an eventual population of 50,000.

Social, recreational and religious groups have developed hand-in-hand with the community's physical growth. Service clubs already established include Chamber of Commerce, Kinsmen, Kiwanis, Legion, Lions and Y's men. A Ratepayers' Association has been organized.

Welfare groups such as the Hospital Advisory Board, Safety Council, Cancer Society, V.O.N., T.B. Association, are very active. A Drama Club has met with much encouragement.

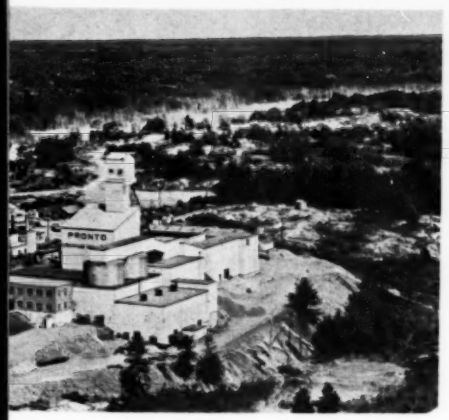
Youth organizations have been formed and have rapidly expanding memberships. These include Boy Scouts, Girl Guides, Cubs, Teen-Town, and Boys' Club.

The Mines Recreation Association has provided leadership in fastball, baseball, soccer, hockey and curling. In addition there is a Rod & Gun Club, Tennis Club, and a recently appointed Recreation Committee that has done work this year with swimming and playground supervision and instruction for children.

The Collins Centre Advisory Committee continues to operate in the interests of furnishing and furthering the use of Elliot Lake's new civic auditorium —the W. H. Collins Centre—donated by Franc R. Joubin and J. H. Hirshhorn, pioneer mine-finders and developers of the district.

Elliot Lake now has ten congregations for which services are conducted; numerous youth and adult groups are active affiliates of these congregations.

In 1956 and 1957, the vast majority of residential building was done by the mining companies that in turn sold housing units to employees on a rental-purchase scheme. A first mortgage was bought by a federal agency, Central Mortgage & Housing Corporation Lim-

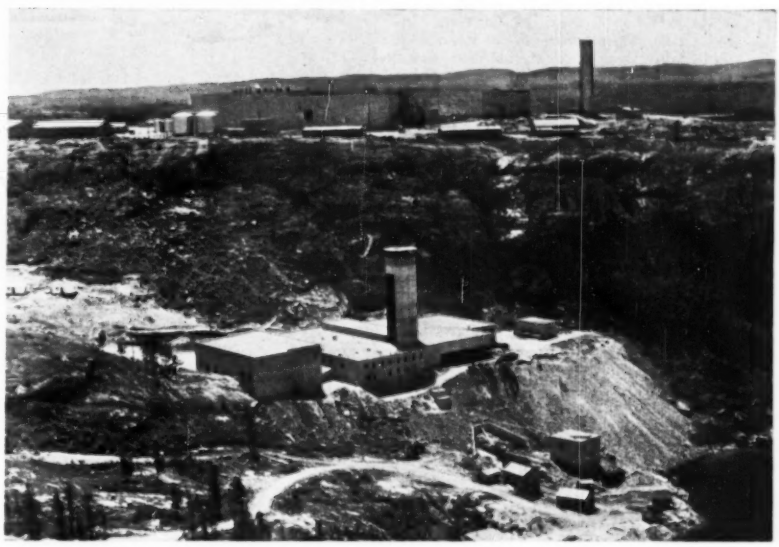


PRONTO

Pronto mine is situated on the original ore discovery and was the first of the area mines into production. It got its name because it was opened "pronto." The ore outcrops on the surface, the ore zone having an average thickness of about 7.5 feet. The immediate region is faulted causing numerous offsets or displacements ranging from a few inches to as much as 60 feet. The mine is served by one shaft intersecting the ore at 260 feet and bottomed out at 965 feet. The Pronto orebody contains three separate and distinct types of ore: a pebble conglomerate, the most important, and comparable to the ore in the other Algoma-Elliot Lake mines; radioactive grits, of secondary importance and consisting of subangular quartz grains and pink-white feldspar grains embedded in fine grained chloritic material; and radioactive quartzites, of least value, seemingly associated with some of the grits and formed of subangular grains of a clear feldspar with subordinate quartz.

STANLEIGH

A main syncline deposit, on the south limb, the Stanleigh property is unique in that the ore occurs in two beds, each about 10 feet thick and separated by a layer of barren quartzite from 5 to 22 feet thick. The ore lies at a depth of about 3500 feet, the mine being served by two shafts. Number 1 is 3800 feet deep and intersects the orebody at the 3500-foot level. Number 2 is 3650 feet deep, also crossing the orebody at 3500 feet.



STANROCK

Stanrock Uranium Mines Limited has an orebody on the north limb of the main syncline at depths from 2300 to 3300 feet. The ore is a minimum of 10 feet in thickness and occurs as conglomerate bands with intercalated quartzite. A thrust fault causes repetition of the ore zone. The mine is served by two shafts. Number 1 bottoms at 3379 feet (from surface) and Number 2, at 2954 feet. Shaft Number 1 is the production shaft and is located on a 200-foot-high bluff overlooking the mine offices, change shacks, warehouse and Shaft 2. Within the bluff are located ore crushing and storage facilities hollowed out of the hard rock. Atop the bluff and alongside the hoist house are the mill buildings. An adit has been driven into the base of the bluff to connect with the underground workings below the mill.

ited, on a 25-year term at 6 percent; the mining companies provided a second mortgage at 3 percent over 15 years in order to reduce the down payment. The bulk of residential lots sold last year went to private individuals, although the mines are still erecting accommodations, chiefly apartment blocks, for rental to employees.

The grand total of 1645 housing units were built by the mining companies in the community of Elliot Lake for purchase or rental. To this should be added 225 residential buildings at the mine sites for key personnel. Obviously expansion will continue for years to come, and the municipality will be faced with greater demand for serviced lots.

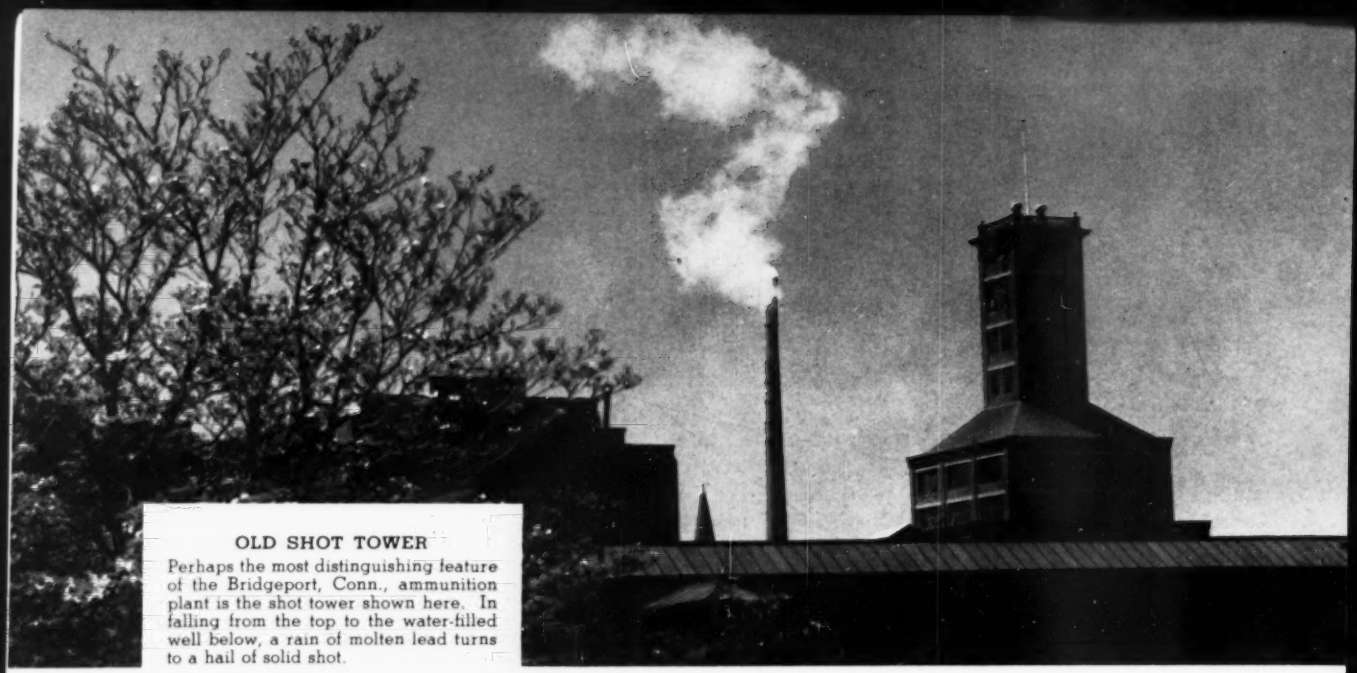
All municipal financing has been with the Province of Ontario. Debenture issues to cover costs of sewer and water installations and school construction have been bought by the Ontario Municipal Improvement Corporation, a provincial agency. Road construction has been financed through lot sales or money borrowed on that account. Debenture sales plus road costs now total some $16 million.

The year 1957 saw the first municipal taxation with a mil rate established of about 60 mils and an assessment of more than $9,000,000. This assessment is climbing rapidly, and reached $15 million in late 1958. This would indicate a replacement value of about $45 million.

Down on the lake shore near the main east-west highway, Pronto Uranium is outside the Improvement District. The Company turned to the lumbering town of Blind River and neighboring unorganized townships to find and house many of its employees, and provided much needed leadership in housing and community affairs.

In the unorganized townships outside of direct government control, a ribbon development has occured. It consists of nests of trailers, shacks and occasional substantial homes, interspersed with industrial and commercial establishments.

No one can accurately foresee the future of this amazing development. The rapid growth in demands for power, and particularly the demands for nuclear power, is making the forecasts of yesterday out of date today. Certainly the Elliot Lake area has reserves in ore, finances, and man power to meet the demands for generations to come.



OLD SHOT TOWER
Perhaps the most distinguishing feature of the Bridgeport, Conn., ammunition plant is the shot tower shown here. In falling from the top to the water-filled well below, a rain of molten lead turns to a hail of solid shot.

A 91-Year-Old Ammunition Factory Gets—

A REVITALIZED AIR PLANT

R. J. Nemmers

REMINGTON Arms Company will mark a ninety-second birthday anniversary in August of its shell and cartridge plant at Bridgeport, Conn., probably the best known of America's sporting ammunition factories. Hunters today recognize, with no difficulty, the trade name of Kleanbore, under which its products are marketed, for Remington claims the lion's share of the sports ammunition market in the United States and has for many years.

On each cartridge is the small insigne, UMC, a meaningless symbol to many younger hunters, but one that is well known to those who were on the trail of game prior to the First World War. It stands for the Union Metallic Cartridge Company, founded in 1878 and the predecessor of the ammunition wing of today's Remington Arms Company, Division of E. I. du Pont de Nemours & Company.

Wartime Expansion

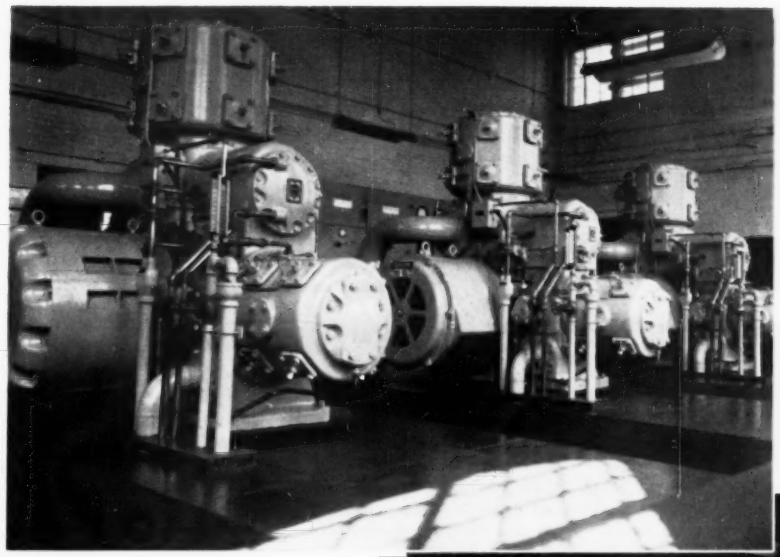
In periods of national emergency, the firm's equipment and plants have been converted to supply the needs of the armed forces—in World War II for example, facilities owned and/or operated by it turned out the staggering total of 16 billion cartridges for the war effort, representing 41 percent of all the small arms ammunition used by the United States not only for its own forces, but to fulfill Lend Lease commitments as well. In addition, 1,084,000 rifles were made by the arms manufacturing wing of the company.

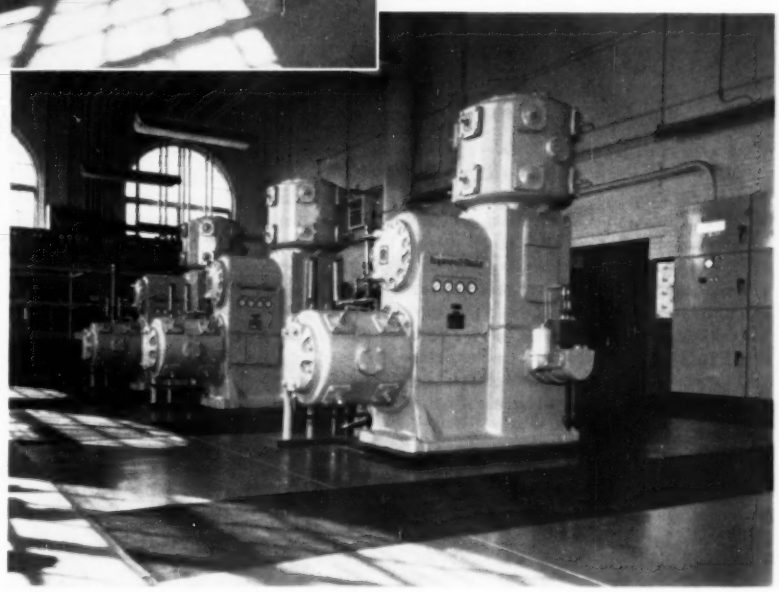
Four times previously in its history, Remington Arms Company had been asked by the Government to convert from sports ammunition to the manufacture of war material. Nothing in its background could compare with the effort that went into the Second World War, however. While war-caused expansions of 25, 50 or even 100 percent were fairly commonplace, Remington Arms grew a total of 2000 percent. Prewar personnel amounted to about 4000; at the peak of the war effort employment soared to more than 80,000. The items produced by the greatly expanded work force had a value of some $1.2 billion, spread through the several war years, whereas the average of Remington's sales prior to the war was only $15 million per year.

Reconversion

The vast swelling of the plants and equipment as well as personnel lists left many problems following the war. Initial plans for the reconversion were laid as early as 1943 when the government began slowing orders for small arms ammunition because its supply depots were overflowing—there was no shortage of cartridges for the men on the battlefields. As additional military contracts were brought to a close, Remington instituted a sweeping Reconversion & Modernization Program—called R&M by the personnel. Placing much emphasis on interdepartmental coöperation and the exchange of ideas, R&M encompassed the home plants of the company—those that were in operation prior to the war and which were to be utilized in coming years to produce the firm's sporting ammunition and firearms, the manufacture of which had been completely halted by the global conflict.

As almost all of the machines used in making equipment and ammunition for the military were not suitable for sports ammunition and firearms manufacture, the R&M program called for new, completely modern facilities—equipment that could make shells, cartridges and guns much more cheaply and in greater volumes than those in use before the war. R&M was not an overnight program—the problems were too complex for that. Almost all of the machines needed had to be specially designed for the task. Furthermore, research and development of new weapons and ammunition had been halted during the war years. Lost time had to be regained, and thus the firm was in a position of requiring virtually all new equipment to manufacture a line that was not as yet developed. In essence, the decision was to tackle the design problems and the R&M program simultaneously, using old machines at first and converting to modern equipment as soon as possible. The whole program was to cover a period of some years.





COMPRESSOR ROOM

Both views of the compressors shown here point out the exceptionally clean Remington compressor installation. All pipe connections to the units are on the motor side and are directed immediately to the basement below. The fact that all air passages between stages and through the intercooler are within the compressors adds greatly to the neat appearance of the installation. The induction-motor drivers are mounted on the crankcase, the rotor being directly mounted on the crankshaft. The units are Ingersoll-Rand XLE 2-stage machines. The motor on the machine in the foreground of the picture at the left is a Westinghouse unit; the other two are of General Electric manufacture. A fourth compressor will eventually be installed in the space in the foreground of the picture below.

Firearms

The Reconversion & Modernization Program introduced to Remington, at its Ilion, N. Y., plant, an entirely new philosophy of arms production. Instead of building an individual gun model, the firm proposed to build a complete line of sporting rifles, shotguns and target arms that all fit into a family—a group in which certain parts would be interchangeable, thus bringing the advantages of mass production to a craft that for years had been founded on short runs. In this way, the firm realized, costs and quality could be kept in hand.

The company believed that guns are not quickly dated; that there can be little or none of the "planned obsolescence" of other fields; and, that firearms are purchased to last a considerable time, perhaps several lifetimes. The guns themselves were simplified—1900 machining operations, for example, that were formerly required to produce one particular gun were reduced to 270.

Ammunition

At the ammunition plant in Bridgeport, Conn., where mass production had been in force for half a century, the R&M program was concentrated on reducing the number of machines required to turn out the thousands of rounds of hundreds of varieties of ammunition needed to keep the nation's sportsmen on the hunting trails. By improving the capacity and speed of the machines, the company was able to grow to meet the resurgent sports market without vast expansion of the physical plant. In the making of battery cups for shot shells, for example, the line was equipped with eight machines having the capacity of 60 previously used units. In bullet manufacture, one machine now outperforms two of the old variety.

One of the outstanding things about the R&M Program was the emphasis that it placed on safety in the plants. Although the layman might consider the manufacture of shells and cartridges to be a hazardous occupation, it is not. The safety record at the Bridgeport ammunition plant is far better than that of industry as a whole. Indeed, its employees are approximately twice as safe at work as they are at home, based on national safety standards, although the statement needs some qualification: Remington workers, as a rule, are probably safer at home than the national average because of the intensive safe-practices training they receive at work.

Continuing Modernization

The original R&M Program was designed to last until the readjustment period following the war grew into a more settled growth pattern. However, so successful was the idea and the cooperation among departments so productive of ideas, that the philosophy of R&M, if not the entire program, stays with the company to this day. It was partially as a result of the R&M philosophy and partially because of the expansion in the utilization of air power in the plant, that the firm decided in 1956 to tackle the redesign of its compressor plant.

Previously the air plant had consisted of several different-sized machines positioned throughout the plant, with the nucleus of the system in the powerhouse. In early years, the air system had grown steadily and with it the need for additional compressor capacity. Machines accordingly were spotted wherever they were required to maintain adequate working pressures at the point of use. With the essential completion of the R&M Program, it was found in some cases that the compressors weren't located in the most efficient spot, and also

Sportsman 58ADL Autoloading 12 Gauge

Fieldmaster Model 572 .22 Caliber

Model 870 AP Slide Action 12 Gauge

Nylon 66 Autoloading .22 Caliber

Model 725 ADL .30-06 Bolt Action

Model 740 ADL Autoloading Rifle

THE FAMILY CONCEPT

Although the manufacture of firearms has for years been a short-run craft, Remington has been able to formulate its line into a family of guns, among the members of which many parts are interchangeable. The relationship of the rifles and shotguns shown above is readily apparent in most cases, yet each is distinctive in its own right.

that they were not of the latest and most efficient design.

Two of the main points in the R&M philosophy are that costs can be reduced by the utilization of the most efficient equipment available, and that proper operation and layout do a great deal to maintain close control over costs. With the compressors scattered throughout the plant, there was no way for plant engineering personnel to supervise and properly maintain the compressed air system efficiently. It is also logical that to control costs, they first must be known, and it was practically impossible to determine true costs.

Accordingly, the engineering staff set about designing a central compressor plant which could be fitted into the old compressor room, and that could be adequately supervised and maintained by a small staff. The plant was to have automatic recording devices and some metering equipment so that costs could be determined. Safety and housekeeping were considered in the design along with the fact that the plant was to be in the midst of the Bridgeport manufacturing complex, thus making it necessary to limit both vibration and noise.

Compressors

The first of three new compressors was ordered in January 1956 and installed in June of that year. Two additional units were called for in October and were delivered in December. The entire plant was in operating condition and had assumed the air requirements by mid-February 1957. The three units, as well as the foundation for a fourth, were fitted into the old powerhouse compressor room, along with control and recording equipment. L-shaped machines requiring a minimum of floor space were chosen. Of 7-inch stroke, the units have 14¼- and 9-inch cylinders for the low- and high-pressure stages, respectively. The low-pressure piston is aluminum to equalize the weight of the steel high-pressure units thus balancing primary inertial forces and reducing vibration to a minimum. The air intake and outlet connections both are on the compressor frame, and the air flows through internally cored passages to the cylinders and through the intercooler. All are driven at 585 rpm by direct-connected 125-hp, 2300-v, 3-phase, 60-cycle induction motors.

The machines are set to yield 115 psig air, each unit having a piston displacement of 680 cfm. (Remington runs the machines alternately so that operating hours average out over a year's period. In other words, machines 1 and 2 carry the base load for 1 month; 1 and 3, the following month; and 2 and 3, the third month.) The compressors have 3-step free-air unloading.

During an average month some 29 million cubic feet of air are utilized.

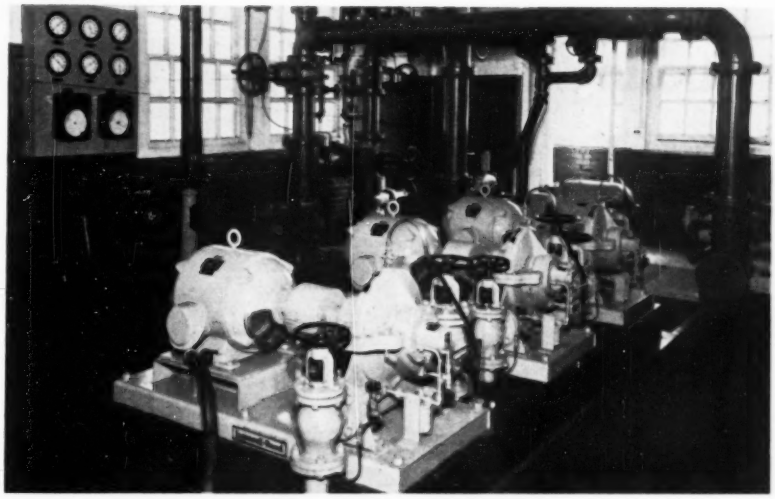
THE UMC TRADEMARK

As a constant reminder of the origin of the ammunition manufacturing wing of Remington Arms Company, shells and cartridges carry the trademark UMC, standing for Union Metallic Cartridge Company.

Output is recorded on flow meters for each of the three machines and an accurate record is kept of system pressure as well as the amount of air delivered to each of the several operational divisions of the Bridgeport works.

Intake air is filtered in separate oil-bath-type filters for each machine. Remington makes good use of drained compressor-crankcase oil by filtering it carefully and reusing it in the oil-bath filters. (At present, the compressors are on a 3-month oil-change schedule as part of the preventive maintenance program in force in the plant.) Each intake line is also equipped with a silencer. After compression, the air is cooled in separate pipeline-type aftercoolers prior to being discharged into the manifold leading to the receiver. Filters, silencers and aftercoolers are located in a shallow basement just below the compressor room and through which the foundations for the machines are carried to solid ground. All piping for the installation is also located in the basement, thus leaving the compressor room free of the customary pipe maze.

Cooling water from the cylinder jackets and the inter- and aftercoolers is drained to a tank sump. From this sump, water is drawn for make-up feed to the process-steam boilers in the plant. In summer, the heat thereby gained is relatively unimportant; however in the cold New England winters, the Btu's gained by this practice add up to a considerable value when compared with using the icy water drawn from the regular plant system. Water is also thus utilized that otherwise would have been wasted. The excess is piped to drainage.



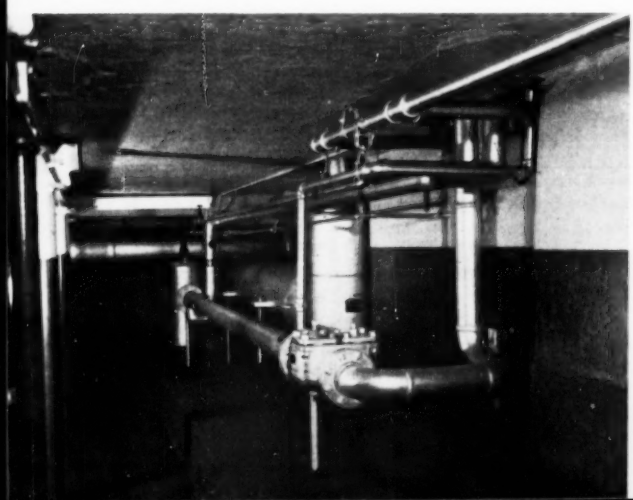
WATER SUPPLY SYSTEM

At approximately the same time that the compressor plant was being redesigned, other changes in the powerhouse aimed at improving efficiency and modernizing equipment were being made. One of them was the installation of new pumping equipment. The center section of the pump room is shown in this view with its battery of three Westinghouse-driven Ingersoll-Rand DVM pumps that supply process water to the plant. Each has a capacity of 400 gpm against a total head of 200 feet. At one end of the room (background) are two high-capacity fire pumps; at the other, (not shown) is a 2 GT unit on boiler feed water service.

The basics of the compressed air program at the Bridgeport works, of course, are that compressed air is vital to many of the operations in the manufacture of shells, casings, etc. Air power has contributed materially to cost-reduction programs, and it is important that adequate volumes at the required pressure are available for all needs. It is also necessary to maintain close control over the actual costs of producing the air, and Remington has found that a well-designed plant utilizing modern equipment and scrupulously maintained meets its needs most adequately. The plant engineering staff keeps a close watch over air requirements and, as we have indicated, the space required for a fourth complete duplicate compressor installation is available when planned reviews may indicate that added capacity is required.

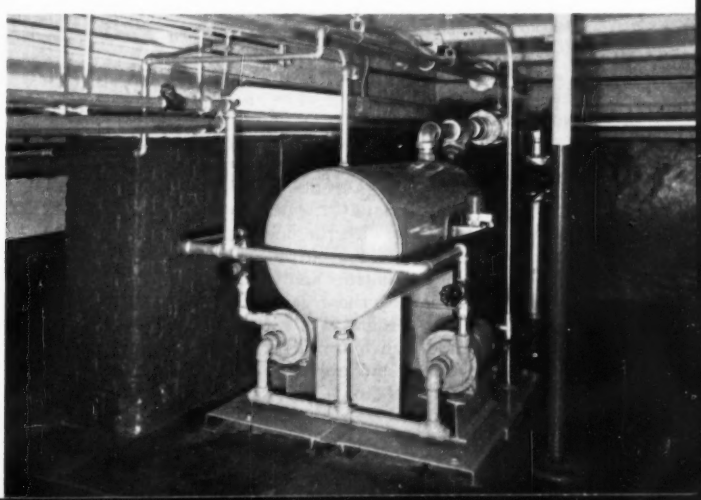
INTAKE AND DISCHARGE PIPING

In a shallow basement below the compressor room are located separate intake filters, silencers and pipeline-type aftercoolers for each unit, as well as space for a future installation to serve a fourth compressor. The accessory equipment is fastened to the compressor foundation block. In this view, an Ingersoll-Rand 35 PL-12 aftercooler is at the left, and an American Air Filter 20W03 oil-bath filter is at the right center with a Maxim 16-8, model MUC silencer just behind it. The silencer is connected to the main intake header that extends to the roof of the building.



COOLANT PUMP

Water heated by passing through compressor cylinders, intercoolers and aftercoolers is collected in this tank in the basement. Ingersoll-Rand KRVSA-3 pumps, at the base, feed the warm water to the boiler make-up lines for the plant's steam supply. The heat thus reclaimed is important in New England's cold winters when the temperature of incoming water may be in the low thirties, in addition to the conservation of water supplies. The 1¼-inch discharge, 3-hp pumps have a capacity of 75 gpm against a total discharge head of 95 feet.



Fueling Jet Aircraft — A Compound Problem

IN ABOUT 5 years, New York City's International Airport will use 60 million gallons of jet fuel monthly to keep England's *Britannia*, *Comet*, *Viscount* and *Vanguard*; America's *Boeing 707*, *Douglas DC-8*, *Convair 880*, *Lockheed Electra* and *Fairchild F-27*; and France's *Caravelle* in the air. With the inauguration of jet passenger service on the major national and international commercial airlines, a new series of ground handling problems has been posed. Not the least of these is fueling.

Conventional practice with piston-engine-driven airplanes is to use a mobile truck that supplies the fuel to an opening on the top of the craft's wing. This practice is satisfactory when no more than 6000 gallons of fuel are needed for the longest flight.

Jet-powered airplanes, however, have far greater requirements. In attaining speeds faster than 600 mph, with full loads for transcontinental and transoceanic trips, they will carry as much as 23,000 gallons of fuel at take-off. This is obviously far beyond the capacities of single tanker trucks. Multiple tanker trailers are uneconomical, both in the initial cost of the equipment and in the time involved in the transfer of fuel. In jet passenger flight, time is literally money. Flights are justifiable only in terms of the greater number of persons that can be transported in a shorter length of time per plane.

The answer to the problem was found by Parker Aircraft Company, Los Angeles, Calif. It is called hydrant fueling.

The system offers many advantages: underground storage of all fuels for maximum safety; centralization of all operations for maximum time and labor savings; concentration of all supplies to assure the availability of ample quantities of the various fuels required; flexibility in the alteration of equipment to meet changing requirements in fuel transfer; minimization of equipment maintenance; and close control over evaporation losses. (Vapor displacement in loading and unloading trucks has been eliminated.)

Another phase of the problem was the prevention of congestion at servicing ramps. The answer to it was found to be the transfer of the fuels under high pressures and at accelerated flow rates. This saves time and prevents possible congestion. Unfortunately, the pressures and flow rates differ with the operating practices of the individual airlines.

A series of fluid controls and connections to accommodate these varying requirements was designed by Parker. Included are a 4-inch hydrant fuel-control valve with an integral adapter; a 4-inch pressure fueling control valve; 2½- and 4-inch hydrant adapters; hydrant couplers, in straight and elbow configurations; an underwing nozzle; an overwing fueling adapter spout; and a quick-disconnect swivel-and-strainer assembly. Together, they offer a refueling system that is simple in design, while at the same time, exceptionally versatile. The close regulation they offer of the rapid flow rates and pressurization assures that the system will function effectively.

Instead of tank vehicles coming to the airplanes, the jets are fueled directly at the loading ramp from huge underground tanks and reservoirs. Some of these range in excess of 1,000,000 gallons capacity. The above-ground portion of the fuel supply is a small hydrant of about 1-cubic-foot volume. This is the key to the operation.

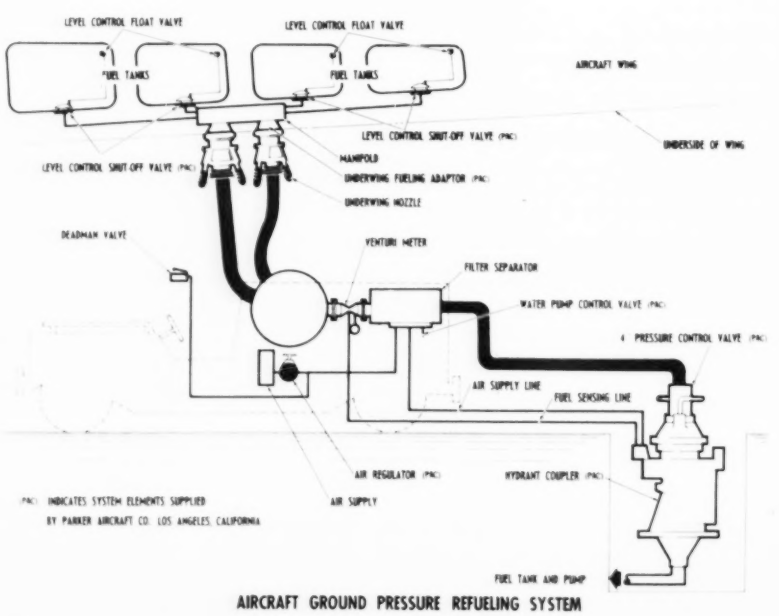
From the recessed hydrant, three hoses run to a small hydrant vehicle, or cart. A 3- to 4-inch main hose carries the fuel. There is a special device to strip the kerosene-type fuel of any dangerous water content. (Fuel supplied to jets must be absolutely water free since the presence of moisture in it may cause engine flame-out by freezing and forming solid ice crystals.)

A second, smaller hose is attached for compressed air. It is the primary control source for the fuel pressure. It also supplies the energy for an emergency shut down.

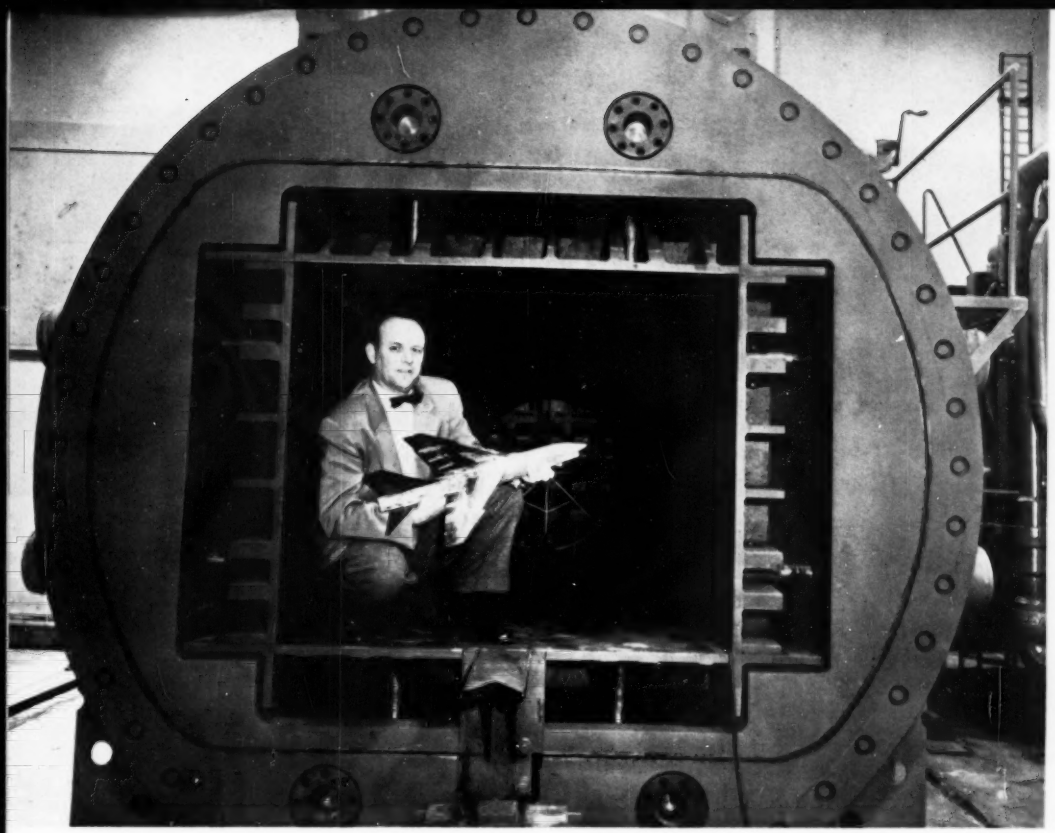
A third hose, also of small diameter, contains fuel and is the means of sensing pressure between the hydrant and the vehicle. Various configurations of jet transports require, and different carriers using the same type of plane prefer, the pumping of fuel aboard at different pressures. These range from 30 to 50 psi. The ability to supply variable pumping pressures is achieved by an air pressure regulator, located at the hydrant vehicle, that can be set by the ground crew to the pressure designated for each type of aircraft.

Several safety mechanisms are incorporated in case of an accident or emergency. One of these is the so-called "deadman" lever that the operator must depress at all times when fuel is being pumped. The instant this lever is released by the ground crewman, refueling operations stop. Thus, for instance, should a truck accidently run over the main fuel hose and sever it, the "deadman" lever is simply released, and the refueling stops. Less than 9 gallons are spilled on the runway—an amazingly small amount when it is considered that the pumping rate will generally be in excess of 1200 gpm.

The hydrant plan, as schematically illustrated on this page, was recently demonstrated at the International Airport in Los Angeles. Fuel was transferred into a mock-up *Boeing 707* wing-tank arrangement at a rate of 600 gpm. Its unquestioned success indicates that one of the perplexing problems of the jet age has been solved.



AIRCRAFT GROUND PRESSURE REFUELING SYSTEM



Holding an aircraft model, an engineer crouches in the 4-foot-square test section of the Chance Vought wind tunnel capable of generating speeds up to 3800 mph.

"Trisonic" Wind Tunnel

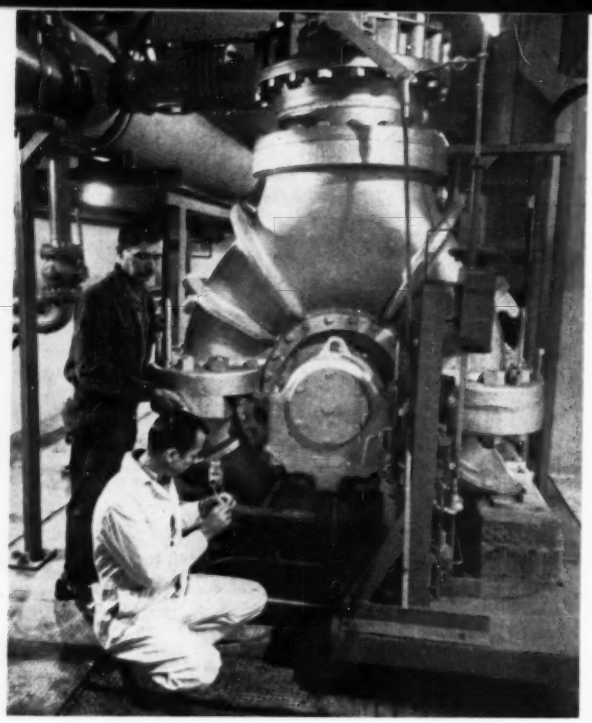
Alec Lewis-Morgan

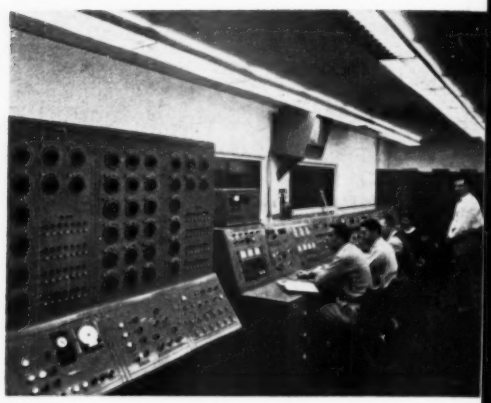
FORTY-TWO tons of compressed air, stored at 600-psig pressure in six immense white receiver tanks, are swooshed through a test compartment to simulate high-speed flight in Chance Vought Aircraft's new wind tunnel. At present, the facility, erected near Dallas, Tex., can attain air speeds ranging from 3800 mph maximum to 380 mph minimum, and expansion provisions, if carried out, would permit tests of Mach 10, or 7200 mph. This ability to achieve air speeds below, through and beyond the speed of sound has given the tunnel its designation of "trisonic." Ironically enough, the first model being tested in the tunnel is an escape capsule for a space vehicle, a case of seeking facts about safe deceleration instead of learning how to attain ever-higher speeds.

This escape-pod test series marks the first full-scale operation of the tunnel after nearly 3 years of designing and building. Design was started in February 1956, and construction began a year later under supervision of Chicago Bridge & Iron Company. Air was first directed through the facility on June 13, 1958, and the contractor carried out some 350 tests before turning over the tunnel to Chance Vought in late October. Before recently changing the tunnel from the test to the completely operational phase, the aircraft concern conducted 150 calibration runs of its own to determine that the installation was operating correctly.

The tunnel is described as a straight-through, blowdown type because it directs a controlled, stored supply of air through its system. The heart of the tunnel is its 4-foot-square throat section where a model of a new missile or aircraft is placed to meet the swift onrush of air. A nozzle here can be adjusted to vary the speed of the incoming air stream. This is also the location where data about the model's reaction to air, and air's reaction to the miniature plane or missile, are collected. During a test, the eighteen men who man the tunnel move into a control room near by. They view the model on a closed circuit television screen mounted above a control console, and they also look at shock waves made visible by an optical system.

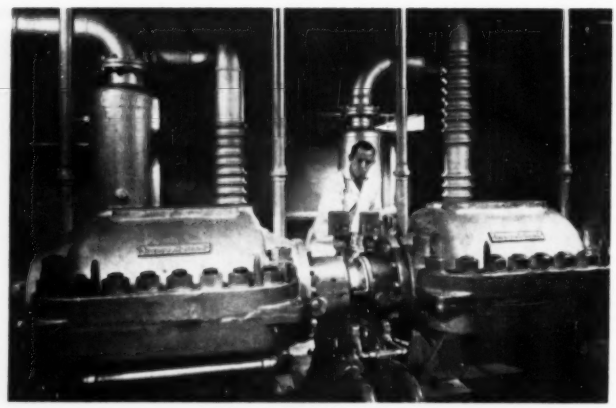
The air in the wind tunnel system follows this course. It enters an inlet outside the facility's building and moves into three Ingersoll-Rand centrifugal compressors. The first compressor is a high-capacity, low-pressure machine, designated as an MGA-652. The compressor operates at 7050 rpm, supplying 18,420 cfm of air at 53.9-psig discharge pressure. The air then travels into a second Ingersoll-Rand compressor, a multistage MGA-533 unit turning at 9850 rpm and rated at 4285 cfm. Here it is compressed to 212.3-psig pressure. The third compressor, also an MGA-533 unit operating at 9850 rpm, compresses 1280 cfm of air and achieves the final pressure of 605.3 psig. The driver for the three I-R compressors is an 8000-hp synchronous motor that operates at 1200 rpm and has speed-increasing gears for





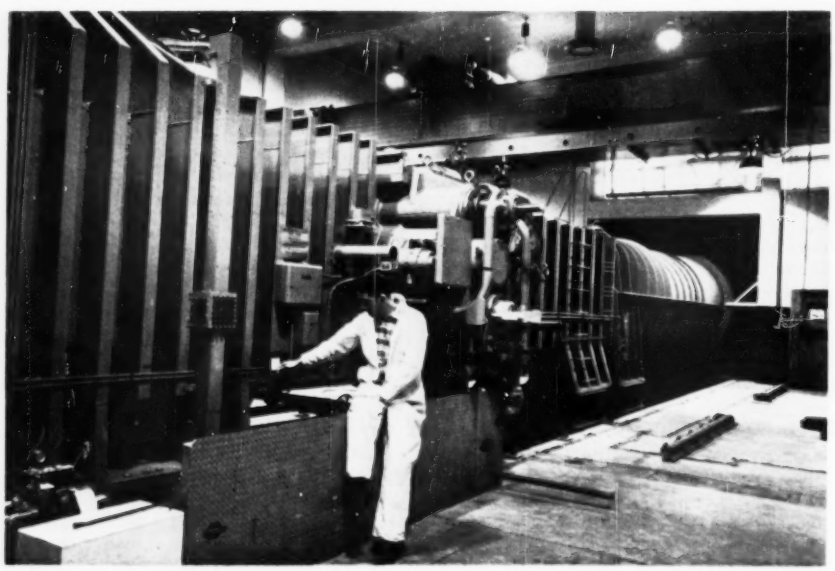
Above, control-room personnel scan dials, meters and a TV screen as data appear.

At left, this high-capacity Ingersoll-Rand centrifugal compressor takes air to an initial 63.9 psig. An 8000-hp motor drives all three I-R machines.



A final pressure of 600 psig is achieved by these two Ingersoll-Rand centrifugal high-pressure units. The air then goes to six huge white tanks.

A technician inspects a component of the tunnel. Air at 600 psig hits a model inside the test cell behind the man. Design allows for changes to achieve speeds of 7200 mph.



the compressors. It was manufactured by General Electric Company.

The air, at approximately 600-psig pressure, is stored in the six huge steel tanks, each of which weighs 100 tons. On its way to the tunnel's test compartment the air passes through a 14-foot settling chamber to smooth the airflow. It is dried and heated to prevent moisture condensation as it is forced through the variable-width nozzle into the test section where the model is mounted. (Models with wing spans of 3 feet and lengths of 4 feet can be accommodated.) Temperature in the test section sometimes drops as low as minus 325°F because of the sudden, extreme expansion.

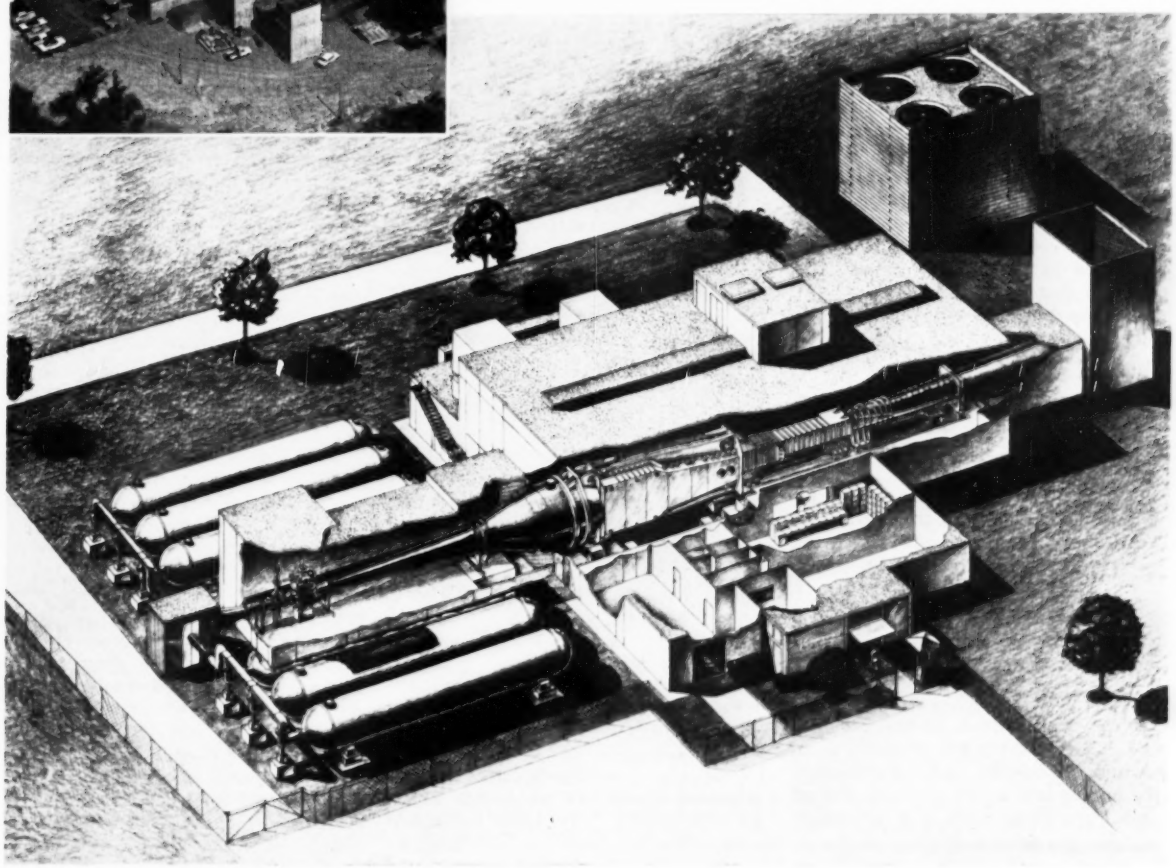
Finally, after it has done its job in the test chamber, the air is exhausted to atmosphere through a baffled Maxim silencing tower. According to Chance Vought, several hundred thousand dollars were spent on the silencer installation alone, to eliminate the two extremely loud and definite noises the tunnel makes—a shrill and a rumble. Each test lasts only about 30 to 40 seconds because all the highly pressurized air rushes from the tanks through the tunnel, but the tanks can be quickly refilled with their heavy load of high-pressure air. From two to four tests can be made each hour.

The high speeds which the wind tunnel attains dictated the short test period, because of the huge amounts of compressed air needed. This in turn meant that the myriad data which must be gathered from a test had to be assimilated in a very short time. An electronic data system was installed to do this. All wind forces and pressures acting on the models are converted into electrical signals, and a high-speed conversion system translates this information into digital form either on IBM punch cards or magnetic tape. During a test, twenty channels operate simultaneously, feeding data from the tunnel's sensing devices into the conversion system. The information is analyzed later to see interactions of the air with the model and to find facts that eventually lead to design adoption or modification.

According to Chance Vought, the new wind tunnel is the largest expansion project carried out by the company since it became an independent corporation in 1954. It is said to be the most complete high-speed facility in the Southwest and one of the few in the United States with such a wide test range. The aircraft concern also has a low-speed wind tunnel that has been in operation for some time. The two tunnels provide complete aerodynamic testing facilities.

Supervisor of wind tunnel operations for Chance Vought is R. C. McWherter, and J. M. Cooksey is acting supervisor of the new "trisonic" tunnel's 18-man crew.

In the cutaway wind-tunnel drawing below, air moves left to right through the tube, into the square test cell, and out the silencer. At left is a photograph of the existing facility, as seen from another angle.



This And That

Home-Grown Quartz

According to a report from Bell Telephone Laboratories, Inc., and Western Electric Company, synthetic quartz now can be produced in great quantities. The home-grown crystals are made by a process called hydrothermal crystallization. High temperature and high pressure are applied to an aqueous solvent that dissolves an ordinarily hard material so that it can be crystallized on a crystal seed.

* * *

Oxygen For Southern Industries

The vicinity of Redstone Arsenal, Huntsville, Ala., will be the site of a large, liquid oxygen and nitrogen producing plant being built by Linde Company, a division of Union Carbide Corporation. The product from the facility will be used by Southern aircraft and missile industries as well as the steel, chemical, petroleum and food manufacturers of the rapidly developing Southland. When completed in 1960, the plant will have a monthly production capacity of 100 million cubic feet of oxygen and nitrogen. Curiously enough, it was Linde that was not only the first commercial producer of oxygen in the U. S., but also the company that was first to build Southern plants during World War I.

* * *

Magazine Stories Merge

Two articles published in COMPRESSED AIR MAGAZINE at a wide interval and seemingly totally unrelated have come together in an interesting science-construction link. Near Salisbury, Southern Rhodesia, the lake being formed by the newly risen Kariba Dam (the construction of which was reported in the December 1957 issue) is trapping many wild animals on shrinking islands that will eventually disappear as the waters rise even higher. The animals have panicked in some cases and many refuse to save themselves. Those that are able to swim are being chased into the lake by game wardens and directed to high ground. Others that refuse to take to the water are being captured and transported to safety. Among the aids being used to take the animals alive are drug-laden syringes fired from air- and gas-powered rifles. The design and development of the flying syringes were described in the November 1958 issue. Although it is hoped that many of the creatures can be saved, some undoubtedly will perish and it is planned to shoot many of those at the last minute in the interests of mercy.

Correction

In February, we were guilty of a common error when we said that certain matter was less than a micron—0.025 inch—in size. A micron is not twenty-five thousandths inch, or 0.025, but is, rather, one twenty-five thousandth of an inch, or 0.00004 inch. Specifically, the micron is a metric measure, defined as one one-thousandth of a millimeter.

* * *

Making Ductile Yttrium

Long considered too brittle for structural uses, yttrium metal can now be made into a pliable, easily formed material that may find applications in the missile field and in atomic reactors. The metallurgy of the process was worked out by United States Bureau of Mines metallurgists at its Albany, Ore., research facilities. The rare earth metal has the advantage of a high melting point—2825°F, about that of carbon steel—combined with a low thermonuclear cross section, a term that means that it offers low resistance to the passage of high-speed neutrons such as those required to sustain an atomic reaction. As with all rare earths, yttrium is found in close association with its neighbors in the atomic table and is difficult and expensive to isolate.

* * *

Federal Grant For Study Of Radioisotopes

Education, like basic economy, is a question of supply and demand. The most recent proof of this statement comes from the Atomic Energy Commission. To meet industry's ever-increasing need for technologists trained to work with radioisotopes, it has granted $80,000 to the University of California for the purchase of equipment for use in radioisotope training courses. The supplies will first be used for the laboratories and instrumentation of three special training courses to be offered in the summer of 1959. Later, they will be used in connection with regular undergraduate curricula in science and engineering. The summer session will be for industrial scientists, engineers, management executives and government representatives, and will consist of a 10-week radioisotope technology study program for practicing industrial scientists and engineers; a 1-week nuclear technology survey course for management to aid them in assisting and supporting their technical personnel; and a 2-week session in radiological regulation and use for local, state and federal representatives concerned with the regulatory and administrative responsibilities in the atomic energy field.

* * *

Alaskan Prospectors' Handbook

An inexpensive 90-page handbook for Alaskan prospectors and others interested in the search and location of ore deposits was published recently by the School Of Mines at the University Of Alaska. The bulletin, entitled *Introductory Prospecting And Mining*, was written by Leo Mark Anthony, an assistant professor of mining extension. It was originally prepared in lesson form to supplement instruction offered by the University, but has now been revised for general distribution. Some of the fourteen chapters included discuss general geology and map reading; rocks and rock structure; ore deposits; geochemical prospecting; small-scale lode mine development; mine promotion and mineral markets; and field tests and sight identification of minerals.

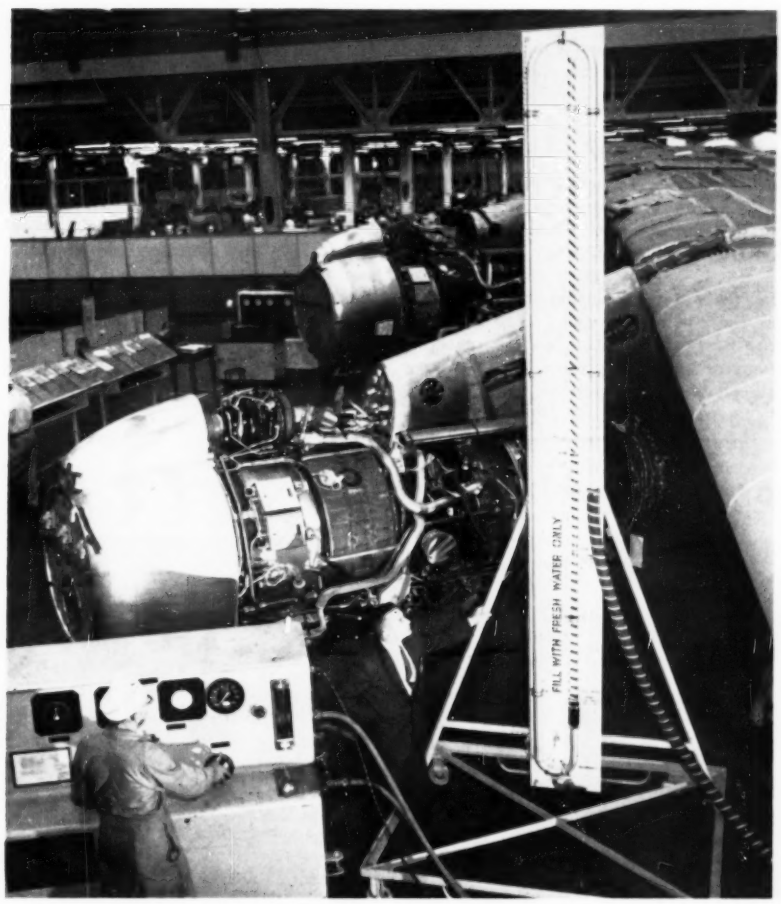
* * *

Wind Prints In The Sands Of Time

A summary of extensive studies into the directions of the winds blowing in ancient times has been published in the British magazine *Endeavour* and reveals that prevailing winds over the Grand Canyon 250 million years ago were blowing opposite to those of today. The same is true of the winds over Great Britain, and the studies seem to confirm earlier theories about the drift of continents and the shifting of the poles. Evidence of the wind directions in ancient eras are literally scribed in the sands of time: prevailing Palaeozoic winds formed sand dunes in the extensive deserts that once covered large areas of what is now the Northern Hemisphere.

The windward and lee sides of the sand dunes are quite distinctive and have been preserved by cementation of the sand with silica or carbonate solutions as the land masses sank into the seas. Now those formations, after aeons under water, are in some places visible. The Grand Canyon and Tensleep Canyon (Wyoming) are two such sites. The studies indicate that in the United States prevailing winds blew from the north-northeast; in Britain, from the east. Winds today are approximately 180 degrees altered. The authors, Dr. Stanley K. Runcorn, Department of Physics, University of Durham, King's College, Newcastle, England, and Dr. Neil D. Opdyke, Geology Department, Rice Institute, Houston, Tex., theorize that a shift in polar placement may have initiated the change. The North Pole at that time may have been slightly north of Korea. By making further studies of the winds blowing over South America, Africa and the Middle East, it might be possible to determine the width of the trade winds at various times in the history of earth. The width of these air currents is dependent in part on the rotational speed of the earth and may serve to prove or disprove the theory that the planet once spun much faster. Present thinking on this subject indicates that the days now are about six times longer than they were a billion or so years ago.

KING-SIZED MANOMETER



Integral fuel cells in the wing of Boeing Airplane Company's 707 must be tested for leaks before the airplane is rolled out of the factory. The air pressure used for testing is critical and must be high enough to assure that no leaks are present without being so high as to damage structural parts. This 14-foot-high manometer does the trick by serving both as a measuring device and as a safety valve. As with all manometers, the top is open to atmosphere. Pressure in the wing can rise no higher than a set maximum (14 feet of water pressure) for above that pressure, the water in the manometer flows out of the top. The device protects against errors in the functioning of equipment on the test bench shown in this illustration as well as against human errors of judgement.

Army Spiders Spin

Webs spun by the black widow spider, female of the species *Latrodectus mactans*, are preferred for cross hairs of transits, levels and other sighting instruments because each strand is a single, uniform filament 0.0002 inch in diameter, rather than being made up of a number of strands, as are those webs spun by other spiders. At the U. S. Army, Granite City (Ill.) Engineer Depot some 4 dozen black widow spiders contentedly spin for the Army and the U. S. taxpayer, on a salary of a few common houseflies per week. The spiders, according to Army News Features, can produce 100 feet of web in just a few seconds. That quantity of the filament sells for about $25 on the open market. The spiders are donated to what might be called the "webbery" by depot employees brave enough to capture them.

★ ★ ★

Bullets Protect Sheep

From the laboratories of the CSIRO (Commonwealth Scientific & Industrial Research Organization), news has come of a "bullet" that releases enough cobalt to sheep to make up for deficiencies. Sheep need the substance to produce vitamin B12, which is essential in blood formation; its lack causes "coast disease" and general ill-health. Previous methods, such as licks and top dressing of grazing lands, are not only inconvenient, but are uncertain and expensive. The Australian discovery solves these problems with a thimble-sized hard object that is administered directly into the gullet of a sheep by an esophageal tube-like gun. The bullet remains in the paunch, releasing the needed cobalt at a constant rate. Since the discovery is but 2 years old, how long the bullet will remain active in the sheep is unknown. Arrangements have been made to market the cobalt bullet throughout the world.

★ ★ ★

Angling With Air

It may not be as relaxing or as picturesque as catching fish by the sportsmen's rod and reel, but herring fishing with compressed air is considerably more profitable. Maine fishermen, having had a streak of bad luck, resorted to the novel method and discovered that after several nights of operation, the catch—valued at $1 per bushel—paid twice over for the major components of the equipment. How does it work? Aerial observations point out the schools. Then, a 1200-foot-long length of flexible plastic pipe is laid, with holes drilled at 1-foot intervals. Air compressors are put into operation at each end. The resultant air curtain,

familiar to readers of COMPRESSED AIR MAGAZINE as a means of keeping sea lanes free of ice, preventing excessive subaqueous blast damage and the like, herds the fish into the waiting seines.

★ ★ ★

Flame Sensing Tubes

What is described as the electronic industry's first universal detection device for use on all types of commercial and industrial heating or processing burners has been developed by Minneapolis-Honeywell Regulator Company. The heart of the system is an ultraviolet-sensitive tube that makes possible the practical use of invisible ultraviolet rays in flame-detection applications. "Since all types of flame emit light in the ultraviolet spectrum, it is possible to use the Ultra Vision system with all fuels, including gas-oil combinations, and on both single and multiple burners," according to Lloyd L. Hamilton of the manufacturing company.

The tube works with an amplifier circuit in a new self-contained C7012A Ultra Vision Flame Detector system to add up the impulses of electrical energy generated by the tube as it counts the ultraviolet rays present in all types of flame. An output of two microamps from the ultraviolet-sensitive tube is necessary to prove the flame radiation circuit and indicate a minimum satisfactory flame condition to assure safe burner operation.

The device responds only to ultraviolet light. It is not affected by hot refractories, incandescent light, hot metal parts or any flickering radiation in the visible or infrared regions.

Applications that are practical for the first time through the use of the C7012A include exothermic gas generators, radiant cup burners and flame-hardening machines. Spark ignition is an excellent source of ultraviolet radiant energy, so the system can be used to prove its presence, too.

The self-contained system, that can be installed in both new and existing burners, includes an ultraviolet-sensitive tube and amplifier assembly. It is easy to install, it is said, since sighting-in can be accomplished quickly and no special wiring is required.

The system has an ambient temperature rating of 50° to 135°F but can be used to sight temperatures to 2200°F without any back light effect. Models are available permitting operation on 120, 208 or 240 volts, 50/60 cycles. For use on 25 cycles, a frequency doubler allows the unit to be operated at the 50-cycle rating.

★ ★ ★

Cooling A Dam With Tubes

To help prevent cracking of concrete used in Williams Fork Dam, Parshall, Colo., 33,000 feet of 1-inch aluminum tubing for water circulation was embedded in the concrete blocks. This removed the heat of hydration as the material hardened. (The project was built by the block-and-lift method. Concrete sections poured, one on top of another, measured 5 feet and more by 50 feet in length. They were the width of the dam's thickness.) By using the aluminum, the contractor—Mountain States Construction Company—estimated it saved $0.30 per foot over the cost of previously used tubing. Furthermore, because of the uncoiling and bending characteristics of the metal, there was no need for mechanical tube benders formerly required. Working with 275-foot coils, two men snaked and anchored the tubing along each section's length. Specially fitted ends protruded from the dam's downstream face to receive and discharge water. After the tubing served its purpose, it was filled with grout.

★ ★ ★

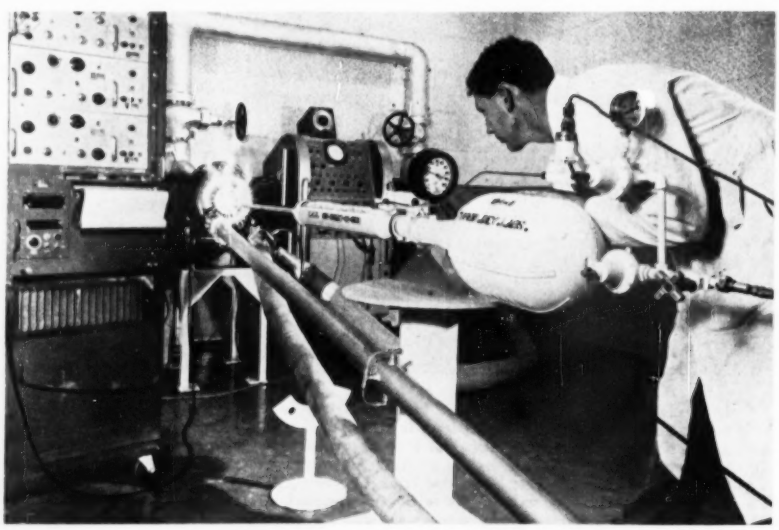
Atomic Wastes Go To Sea

Radioactive wastes from a Santa Susana, Calif., Nuclear Power Station, located in the Simi Hills, approximately 36 miles northwest of downtown Los Angeles, are disposed of in a manner reminiscent of old-time gangsters' habits of getting rid of enemies. The activated wastes, which could cause damage if not protected, are placed in drums and encased in cement and dropped into the sea. Radioactive liquid is pumped into holdup tanks that are contained in shielded vaults outside the reactor building. The liquid is held in these tanks to permit radioactive decay. It is then drained into one of two 5000-gallon storage tanks. These are emptied periodically, the liquid being placed in drums for its "gangland fate."

Compressed Air Fires Ice

ICE bullets that are shot by compressed air are used by The Garrett Corporation's AiResearch Manufacturing Division, Los Angeles, Calif., to prove the reliability of turbine blades. The blades are a part of an AiResearch turbocompressor (designed for the Boeing 707 airliner) which is, in turn, a part of an air conditioning and pressurization system produced both for commercial and military jet aircraft in the United States.

The compressed air, stored at 80-psig pressure, is used to blast molded ice bullets, measuring ¾ inch in diameter, into the whirling blades of the turbocompressor at a rate of one a minute. The velocity of the pellets when they reach the blades is about 675 feet per second. By this means, the scientists are simulating icing factors incurred under flight conditions when the 707 is making a transcontinental run at an altitude of 30,000 feet. According to reports from the Division, all turbine blades have withstood the test.

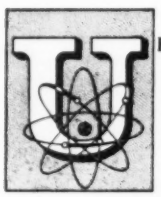


MAN-MADE ICING

This technician directs ¾-inch-diameter ice pellets, at a rate of one a minute, into a turbocompressor to simulate flight conditions of jet aircraft at 30,000 feet.

EDITORIAL

Uranium



URANIUM occupies a unique place in the world of today. Less than 5 years ago the mineral inspired a search as feverish as any gold rush, yet today the heavy metal, while not a glut on the market by any means, is no longer in short supply nor is it likely to be so for any time. The United States Atomic Energy Commission, the free world's largest purchaser of uranium compounds, has instituted modifications of its purchase program to guard against serious overproduction, both in the United States and in foreign nations whose chief market is the AEC. The modifications were not made because of any change in the forecasts of needs of the Commission or of commercial interests, but rather because of the abundant supplies discovered and developed in the last few years.

WORLD uranium figures are not known exactly because of the difficulty of adjudging the output of iron curtain countries. In the free world, however, the United States and Canada share first place honors, both nations now operating at an annual rate of about 15,000 tons of uranium oxide (U_3O_8), the gold-colored stuff from which the metal is refined. The U. S. produced 12,560 tons in 1958 and purchased some 19,000 tons, 12,800 tons coming from Canada and the remainder from South Africa, the Belgian Congo, Portugal and Australia.

At the close of 1958, uranium ore reserves in the United States were estimated to be about 82.5 million tons averaging 0.27 percent U_3O_8. Ore reserves in Canada at the same time stood at 377 million tons of slightly more than 0.1 percent average uranium oxide content. Output of U_3O_8 in both the United States and Canada is expected to remain at the current rate for quite some time, and production in the Union of South Africa has been pegged at 6200 tons of oxide annually.

URANIUM is the Dominion of Canada's most important mineral today. Estimated value of its production in 1958 was more than $298 million as compared to second place nickel's $197 million. Until 1953, Canada's uranium output came exclusively from deposits at Port Radium in the Northwest Territories, 920 air miles north of Edmonton, Alba. Mining there, for radium, dates back more than a quarter of a century, but the mines had been closed in 1940 for lack of demand for radium. They were reopened in 1942 with the advent of the nuclear age. Uranium from Port Radium was in the first fission bombs.

With the discovery in the early 1950's of the ores at Bancroft, Uranium City and finally Elliot Lake, a boom was triggered in the Dominion that eventually resulted in an investment of some $400 million in mines and mills. The most fabulous of all developments is the one at Elliot Lake, known variously as the Blind River and Algoma developments. Any of its designations is a magic word in Canadian mining annals. They signify mines into which some $267 million has been sunk and out of which will come about $1.1 billion worth of the total $1.5 billion value of current Dominion contracts for the sale of uranium concentrates. The contracts run out in 1962-3.

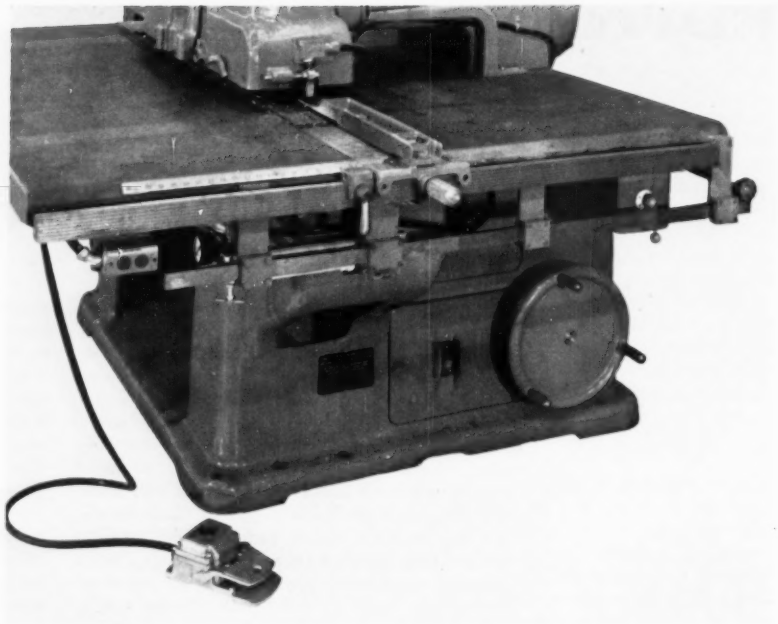
The eleven mines of the Algoma region sit upon about 92 percent of Canada's known ore reserves. The eleven mills have an installed daily capacity of almost 35,000 tons of ore from which an average of approximately 35 tons of U_3O_8 may be extracted.

GETTING the ore out of the ground at Algoma and into the mills is a job for compressed air and rock drills. Thirty-three compressors aggregating approximately 17,000 hp are furnishing a total of about 94,000 cfm of air at a pressure of 110 psig serve the underground workings. In the mills, ion exchange columns make it possible to extract the values from leach liquor, and the ore is leached in air agitation tanks. A total installed capacity of 78,000 cfm of air is available to the mills at pressures of about 45 psig. The 48 compressors installed for that service have a combined rating of approximately 10,500 hp.

Disk and drum filters, more than 200 of them, require a vacuum capacity of 210,910 cfm at a vacuum of 24 inches of mercury: the pumps, 43 of them in all, total 9550 hp. Mine hoists aggregate almost 29,000 hp in 24 units, not counting many slusher hoists operating underground. About 24,000 gpm of pumping capacity is required for mine dewatering, and in the mills, a variety of pumps handle acids and alkalis as well as abrasive slurries.

COMPRESSORS and vacuum pumps, rock drills and pneumatic tools, are among the most necessary of all equipment in winning uranium from the ground and converting it to a usable form. As with so many other industries, the very foundations of the nuclear age rely on the technologies of compressed air and vacuum.

Pneumatic Positioning



RIPSAW WITH AIR-CYLINDER

View of the infeed side of the Mattison straight-edging ripsaw equipped with a remote-control panel lay-up gauge. The foot pedal for the control, which actuates an air cylinder, is at the lower left in position for the operator. A sliding rack bar is at the front of the saw. Its rack teeth mesh with teeth of a spur pinion at the far right. During operation this bar and its ripping gauge are moved by the low-pressure air cylinder. A similar bar at the rear of the machine moves to a point indicating the correct width to cut the final wood piece of the panel being formed.

ONE advantage of an air cylinder is that it provides positive, accurate and well-cushioned positioning of objects it moves. An outstanding example is found on a modern device, called a panel lay-up gauge, that is used with straight-edging ripsaws manufactured by the Mattison Machine Works, Rockford, Ill. Flat wood panels are made by gluing several random widths together at the edges. Usually widths of wood pieces going into such a lay-up vary because the wood has been trimmed to remove knots and other defects.

Matching separate panel pieces so that they will all be the same rough width has been an awkward operation in the past, especially in getting the final one ripped wide enough to bring a glued-up width to the correct dimension. To obtain the right width for this last piece is the job of the panel lay-up gauge. Although gauges may be manually operated, a better type is a remote-controlled one that uses a low-pressure air cylinder.

These air-operated gauges are available either for right- or left-handed operators and use a lay-up table either to the right or left of the off-bearer table at the rear of the machine. In either case, one sliding rack bar is used at the front of the ripsaw table, and another at the rear. When the table is located to the right of the off-bearer, the sliding rack bars at front and back must travel in opposite directions. In such a case, rack teeth are on the top of one bar and the bottom of the other. The two are connected by a reach rod or shaft, with pinions at both ends, running from front to back of the machine table. When the lay-up table is to the left of the off-bearer, both sliding bars must travel in the same direction, and both have their rack teeth on the same edge.

For operation, an adjustable stop on the lay-up table is first set at a specific distance from a register line that corresponds to the width of the panels to be formed. Each piece of material is then ripped as wide as its condition will allow. One piece after another is placed edge-to-edge against the preset gauge, until it is evident that one more piece of wood will finish the required rough width. This final piece must be cut to just the right size.

A foot-pedal switch, that can be actuated either by the operator or the machine's off-bearer, closes an electric circuit to actuate a solenoid valve. The valve admits low-pressure air to a horizontal cylinder at the front of the machine. The piston of the cylinder is connected to, and actuates, the horizontal slide bars along the front and rear of the machine.

The rear sliding rack bar carries a vertical panel-gauging bar. This comes into contact with the edge of the unfinished panel. The action moves the ripping gauge an identical amount. When contact is made, sliding action on the rack bar ceases and the ripping fence becomes stationary at the point where the final piece will be the correct width. With the pedal still depressed, this last piece is run through the machine. When the panel is released, the circuit energizing the solenoid is broken, allowing the saw fence to return to zero.

MAMMOTH STRAIGHT EDGE

Diamond Gardner Corporation needed a large straight edge that could hold close accuracies over a long span, and yet one that was lightweight enough to be moved about the shop. In the required size, a cast iron edge would weigh in excess of 900 pounds, therefore magnesium was tried and found ideal. The production of this tool, illustrated left, was performed by Monarch Tools, Inc., of California, and the result of the project has produced what is thought to be the world's largest master straight edge. Made of Dow magnesium tooling plate, it is 12 feet long, with a section dimension of 12x2½ inches. It was handscraped to an accuracy of 0.0005, overall. Due to the uniform expansion of magnesium, the normal temperature expansion of this 178-pound tool is only 0.0005 inch, overall.

SAVING WITH AIR POWER

Application: Finishing Aircraft Flap Tracks

A PROMINENT midwestern engineering - manufacturing concern makes flap tracks for a West Coast manufacturer. These forged-steel tracks guide important control surfaces of planes and must be precision finished. The forgings are milled on all surfaces and are drilled not only for fasteners but also to lighten their weight; in fact, more than 60 percent of the material in the original forging is removed during machining and finishing operations. Then, all milling cutter marks must be removed, all holes carefully deburred, and all surfaces buffed.

This company had been using three flexible shaft grinders for the grinding, buffing and deburring operations, but these grinders were too slow.

Two new types of equipment were put into use. Ingersoll-Rand Size 2S60 grinders were adopted for buffing out milling cutter marks. The grinders were fitted with 4x1-inch buffing wheels for some operations and with 6x¼-inch cotton bonded wheels for others. These wheels were mounted at the ends of the grinder arbors to allow working on both sides of the raised center of the flap track. This eliminated the need for moving the track.

Size 00 I-R grinders were also fitted with ⅛-inch wheel adapters and two 1½-inch diameter split-periphery sanding disks mounted back to back. These tools were used for deburring, chamfering and polishing the 1½-inch holes in the flap tracks. Cutter marks on some surfaces were also removed with ¾-inch sanding drums mounted on these tools.

The company learned that the pneumatic grinders were vibration-free, insuring top quality finish; that they retained their maximum cutting speed under load, increasing work output; and that they did not overheat. Production per man was tripled—the main goal in the change of equipment—and operator fatigue was reduced.

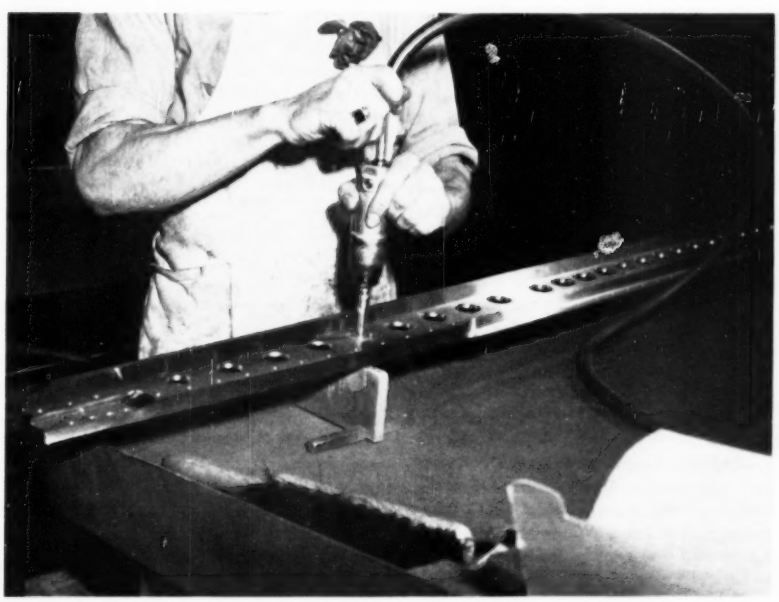
In all, nine sanders and nine grinders were put to work. With a wage rate of $2.21 per man-hour, the company has determined that its daily savings with these air tools is a sizable $318.24.

SANDING OPERATIONS

The Ingersoll-Rand Size 2S60 grinder buffs both sides of the flap track center web to a satin finish without the track being moved. Air tools save $318 daily.

DEBURRING OPERATION

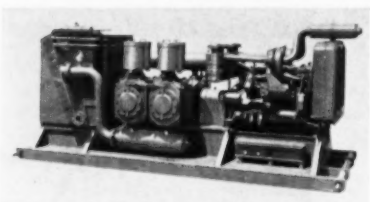
Holes drilled in forged-steel aircraft flap tracks are deburred and polished with this I-R Size 00 grinder. Each hole receives two or three passes with the air tool.



"For Heaven's sake, have another badge picture made—that one looks like you."

Industrial Notes

A SELF-CONTAINED, skid-mounted compressor plant, designed for continuous operation in air drilling of oil wells, has been introduced by Ingersoll-Rand Company. The sturdy packaged unit, said to be especially engineered for heavy-duty work, consists of a 2-stage, reciprocating Channel-Valve-equipped compressor and its turbo-charged diesel driver; a combination, 4-unit, forced-air cooler, with the fan driven by a vee belt from the compressor; and auxiliaries. All are mounted on a 1-piece steel skid that can be carried on a conventional highway truck to a working location. There it can be set on timbers or on level ground; no special foundation is necessary. It can then be quickly hooked up for operation. An adjustable regulator maintains the desired discharge pressure. When a previously selected pressure is reached, this device unloads the compressor and slows the engine to idling speed. When the pressure drops, the engine returns to driving speed and the



compressor loads. Form 3243 describes this new air drilling plant and is available from the manufacturer. *Ingersoll-Rand Company*, 11 Broadway, New York 4, N. Y.

MONITOR is a unique, spherical, 1-hand-operated, multi-purpose fire extinguisher. Because of its shape, the 2½-pound dry chemical unit permits it to be placed in almost any location where space is at a premium. The spent cartridge can be instantly replaced after use to provide uninterrupted fire protection. Each of the recharges is filled, pressurized and sealed during the manufacturing operation; and no pressure gauge is required, for the proper charge can be determined by weighing. The cartridge remains fully charged indefinitely, provided it is not punctured. Its

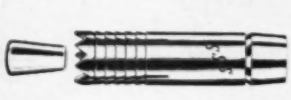
hanging bracket also serves as a locking device to avoid accidental discharge. When removed from its holding device, it is ready to operate. The unit is said to have a rated effectiveness equal to eight pump-type, 1-quart carbon tetrachloride extinguishers, and is approved by Underwriters' Laboratories. *Ansul Chemical Company*, Marinette, Wis.

JARGON of the space age, newly coined, is contained in a glossary of astronautical terms entitled *Space Talk*. The pocket-sized booklet translates 133 of the favorite words from the vocabularies of space scientists and engineers. It was compiled by Dr. William J. O'Donnell, chief engineer for aircraft and missile development at Republic Aviation Corporation. It includes such items as "auntie" (antimissile missile), "magnetohydrodynamics" (study of the interaction between magnetic fields and electrically conducting fluids and gases) and "zip fuel" (high-energy jet engine fuel). *Republic Aviation Corporation*, Farmingdale, Long Island, N. Y.

AIR LINE regulators have a pressure relief valve that allows increases in downstream pressure to bleed harmlessly into atmosphere when the pressure exceeds the regulator setting. Adjusting the regulator knob sets pressure by turning in one plane of rotation so there is no thread action to extend the height of the unit. It is said this constant-height design gives the device versatility in installation. Its lack of protruding handles and conical bonnets provides for installation in not-easily-accessible locations. If maintenance is required, it is not necessary to remove the regulator from the air line; the replaceable chrome-plated poppet valve stem may be removed from the regulator, and a new assembly inserted, leaving the line untouched. The units reduce primary line-operating pressures of 250 psig, and will maintain desired downstream pressures to 50 psig, 125 psig, and 250 psig, these capacities obtainable in separate units. Both wall or through-panel mounting brackets are available; the regulators also are available with or without gauges. Currently, they are built in ¼- and ⅜-inch sizes. *The Bellows Company*, Akron 9, Ohio.

MECHANICAL seals that are said to stop leakage of gas and liquids around compressor, pump and mixer shafts are included in a 4-page flier. The seals reportedly eliminate adjustment, repacking and other maintenance. Three pages contain typical installations, complete descriptions, data and specifications of seals for shafts ¼ inch to 3 15/16 inches in diameter. The final page presents details of Roll Neck Seals which are said to provide 2-way sealing for keeping lubricant in, and water out, of rolls-in-strip, tempering and other rolling mills. *Syntron Company*, 882 Lexington Avenue, Homer City, Pa.

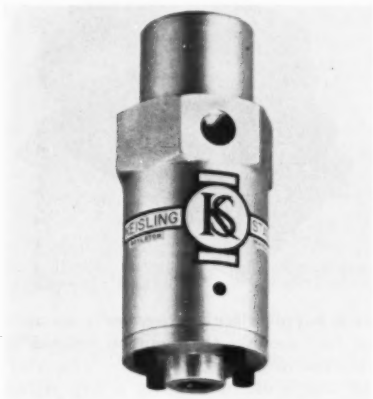
STAR Selfdril Shield, a rustproof masonry anchor that drills its own hole, is said to secure fixtures so firmly that masonry will fail before the anchor gives way. It has eight sharp teeth that cut into masonry producing a clean, close-fitting hole. Made of hardened steel, the drill is expanded in the hole when driven down on a tapered steel plug. Expansion occurs when vertical slots are forced apart as the shield is forced downward. On the surface tip of the device are internal threads for receiving standard ma-



chine bolts or screws. Fixtures secured to the shield may be removed and replaced, but the installation of Selfdril is permanent. Four types and many sizes are available that are suitable for any kind of bolt fastening. The picture above shows the chuck-end type that is installed with either an air- or electric-powered impact hammer. It is normally

used in construction. A flush-end variety, widely used for maintenance work and occasional jobs, is similar in design but has no chucking end. Other kinds are available for installing threaded rods, hung ceilings, lighting fixtures and guy wires. *Star Expansion Industries Corporation*, Mountainville, N. Y.

AUTOMATIC tank drains for use on intermittently operating compressors that unload to atmosphere are available from Keisling-Stanley Company. Each

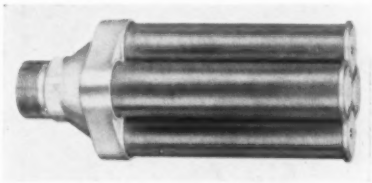


valve is machined with an aluminum body and utilizes a brass piston-and-shaft assembly. Available in ½-inch pipe size with ⅓-inch activating and discharge ports, they are also suitable for other applications requiring a controlled movement of air. *Keisling-Stanley Company*, Boylston, Mass.

INFORMATION about finishing is contained in a 12-page publication, A-659, that emphasizes that such a system must be planned from the standpoint of production as well as the product. The booklet points out that an efficient system is more than a series of cleaning, rust-proofing, drying, painting and finish-baking units placed end-to-end. It states these processes must be engineered and coördinated to obtain the finest finish at the lowest per unit cost. Illustrations feature typical custom installations in operation in automotive, appliance and other industrial fields. Alternative ideas are included for improving or building new installations involving drying and baking, and dust, fume and fog control. *R. C. Mahon Company*, E. 8-Mile Road, Detroit 34, Mich.

"Cut that out! I'm not the one who picked this spot to build a skyscraper."

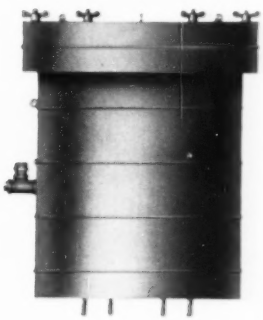
SPACE savings of several hundred percent are reportedly possible with the radial multipass Atomuffler that achieves compactness by use of a vane that channels exhaust air into four silencing chambers. According to the manufacturer, the muffler effectively silences steam and air-operated devices, pumps, blowers and the like, having 3- to 6-inch NPT exhaust port openings. Use of four exhaust silencing chambers, instead of the



traditional one, gives the muffler an enlarged exhaust area. The device uses the principle of equal and opposite can-

FILTER-SILENCERS

for air intakes of engines • compressors • pressure blowers



Silencing intake noise as well as cleaning of intake air are combined into one compact, efficient unit. Keeps harmful dirt from engines, compressors and blowers. Cuts noise level in engine and compressor rooms. Available in oil-wetted, oil bath and dry types. On oil-wetted type intake dust is impinged on a series of oil-wetted wire baffles. On oil bath type (used when dust concentrations are high), filter media is enclosed in a bowl containing oil to scrub the air before the air enters the filtering media. Dry-type for use where oil-free air and fine degree of filtration are required.

Furnished in standard sizes to 6,500 cfm. Write for Bulletin FSC-353. **The Air-Maze Corporation, Dept. CA-4, Cleveland 28, Ohio.**

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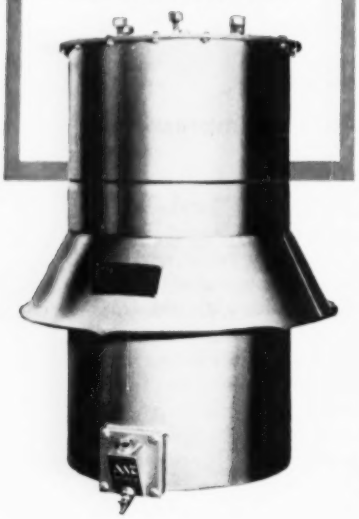
OIL SEPARATORS • GREASE FILTERS

AAF Cycoil Oil Bath Air Cleaners Give Positive Protection



AAF Type "W" Cycoils have proved themselves in thousands of installations—even where dust conditions were most severe. High collection efficiency and virtually maintenance-free operation have made Type "W" Cycoils favorites in all industries.

The operation of the Cycoil is unique. A combination of oil impingement, centrifugal action, and filtration results in practically 100% dust removal in standard A.S.H.V.E. tests.

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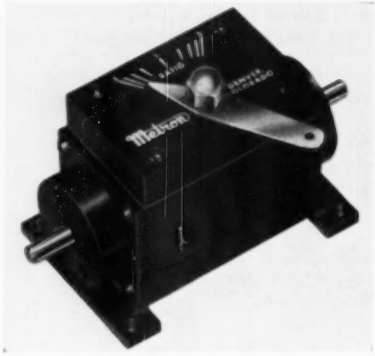
402 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

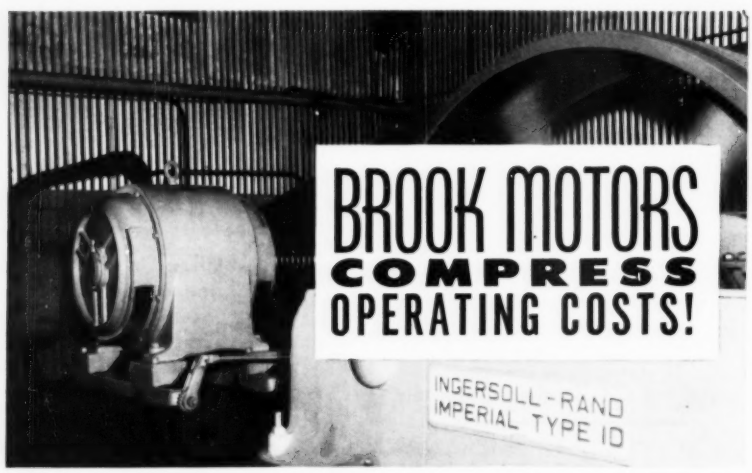
celing forces to silence noise. Streams of exhaust air are dispersed as they enter the silencing chambers. The resultant jets of air are reflected into opposing forces. Collision of these focused forces reportedly cancels the energy of the air before it can become irritating noise. A disseminator diffuses the lower velocity exhaust air into the atmosphere, eliminating dangerous air blasts and oil spray contamination. Said to be sturdily constructed of noncorrosive material, the muffler requires no special tools or skill for installation and can be mounted in any position. The devices are fitted to openings according to the nominal diameter size of the exhaust pipe opening. *Allied Witan Company, Inc.*, 12500 Bellaire Road, Cleveland 35, Ohio.

DESIGNED for holding parts varying in size and shape, a self-centering air vise locates a center or other point automatically for machining work. Two opposing jaws are actuated directly by air cylinders on both ends of the vise. Movement is synchronized within a tolerance of 0.001 inch by a gear and rack in the base, protected from dirt, chips and coolant. The jaws are mounted on two hardened and ground parallel bars to maintain alignment, and semisteel body castings provide strength. The device's jaws are 4 inches wide and can be set for a 4⅛-inch opening; they automatically adjust in relation to center. *Heinrich Tools Inc.*, Racine, Wis.

INCREASED accuracy, better repeatability and longer life are said to be advantages of a miniature adjustable-ratio speed changer. The device, Series 2, has an aluminum, black anodized housing with a long, easily read scale.



It is supplied with either servo mounts, or foot mounts that can be rotated 90 degrees in either direction. The overall length of the housing is 2⅝ inches. Stainless steel input and output shafts of 3/16-inch diameters run in double heavy-duty shielded ball bearings. The speed



Users report savings on operating costs when BROOK A.C. MOTORS furnish power for compressors, pumps, conveyors and machinery in factories, mills and mines. Brook Motors require less maintenance. There is no finer motor built, yet they *cost less.* All standard enclosures, including NEMA Rerates. 1 to 600 H. P. Warehouse stocks, factory representatives and dealers coast-to-coast. Send for literature.

SINCE 1904
BROOK MOTOR CORPORATION

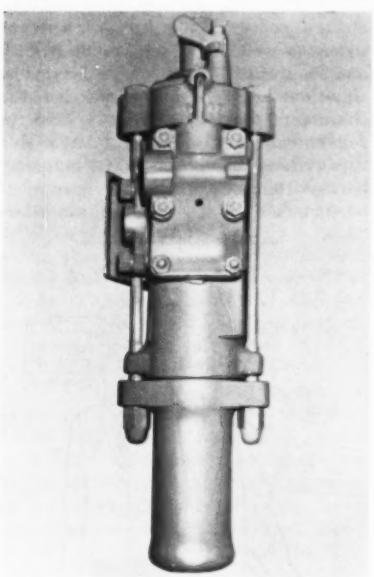
world's most respected motor

BROOK MOTOR CORPORATION
3302 W. PETERSON AVE., CHICAGO 45, ILL.
In Canada: Brook Electric Motors of Canada, Ltd.
250 University Ave., Toronto, Ontario

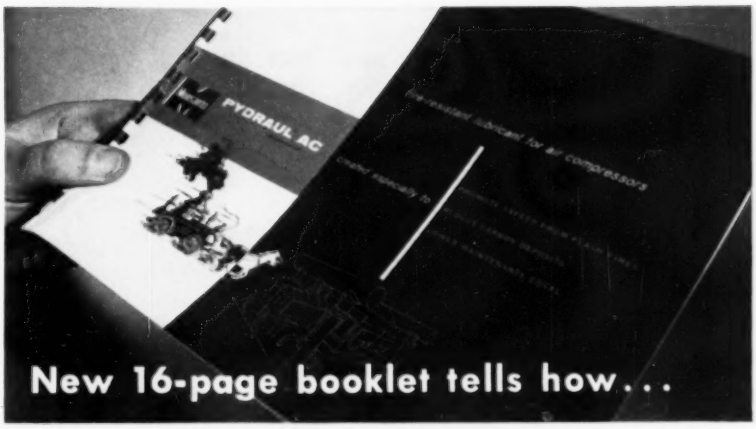
changer may be integrally mounted with the manufacturer's fixed ratio speed reducers, or angle drives, to form versatile combination units. The speed changer has a maximum horsepower output of 0.025; a maximum speed of 10,000 rpm; and speed adjustability in ratios producing a 25:1 over-all range. *Metron Instrument Company*, 432 Lincoln Street, Denver 3, Colo.

PIPE users will be interested in Bulletin No. 59, a condensed catalog that details the complete line of Naylor Pipe Company's pipe, fittings, flanges and connections. Data presented include standard specifications for Lockseam Spiralweld pipe in sizes from 4 to 30 inches in diameter, illustrated data about 1-piece Wedgelock couplings and other types of connections, standard fittings for lightweight pipe and welding flanges. In addition, ordering information and applications in diversified industries are presented in concise form. *Naylor Pipe Company*, 1230 E. Ninety-second Street, Chicago 19, Ill.

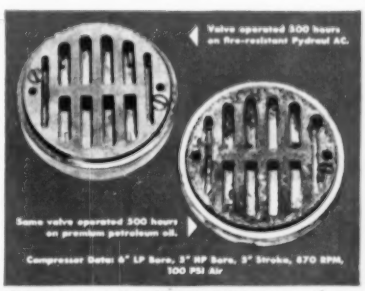
DEEP-HOLE drills, to be efficient, should allow the operator to make easy steel changes. One way this can be done is by changing the rotation of the drill so that the power of the unit can be put to work for the coupling or uncoupling operation. This feature has been incorporated into Ingersoll Rand Company's Model D40 heavy-duty



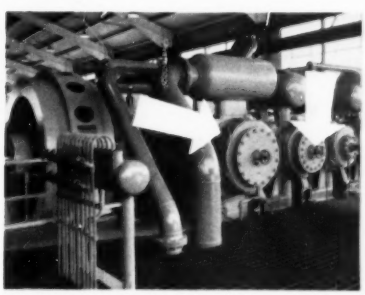
deep-hole hammer drill. It utilizes conventional (left hand), as well as reverse (right hand), rotation. A selector in the drill's backhead permits change from one to the other. The D40 has a 4-inch bore and can handle bits to 3 inches in diameter. A locked-in 1½-inch round



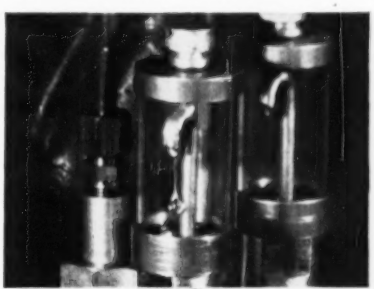
PYDRAUL AIR COMPRESSOR LUBRICANT GIVES 3 "MOST WANTED" BENEFITS AT LOWEST COST: LOW UPKEEP, PEAK LUBRICATION, FIRESAFETY


Valve operated 500 hours on fire-resistant Pydraul AC.
Same valve operated 500 hours on premium petroleum oil.
Compressor Data: 6" LP Bore, 3" HP Bore, 5" Stroke, 670 RPM, 100 PSI Air

PYDRAUL AC RUNS CLEAN—can substantially cut compressor upkeep costs because it reduces build-up of carbon and other deposits—extends time between overhauls. Side-by-side photos (above) of an exhaust valve—used in the same industrial air compressor with only the lubricant changed—show how Pydraul keeps systems freer from harmful and dangerous deposits than a premium oil. Lower maintenance costs alone usually justify use of Pydraul.



FIRESAFE PYDRAUL AC GIVES protection 2 ways in this danger zone—guards these three 4,000-hp. compressors. Petroleum oil residues deposit inside cylinders, valves, piping—glow hot and flake off—can unpredictably ignite flammable vapors from hot petroleum-based lubricants, causing fire...explosion! Monsanto's synthetic lubricant, Pydraul AC, essentially eliminates this basic cause of most compressor fires and explosions: It lessens carbon deposits and oxidation residues, and it is *fire-resistant*.



PYDRAUL AC LUBRICATES like premium-grade oil—good anti-wear and noncorrosive features give equipment long life. And Pydraul is the one lubricant for virtually every compressor you own—has demonstrated excellent lubricating efficiency in hundreds of compressors of all sizes produced by all major manufacturers—gives trouble-free compressor operation for many years. Now, Pydraul is effectively lubricating compressors operating at over 4500 psi.—many operating continually with exhaust air temperatures of 340°F.

PHOTO COURTESY GRACE CHEMICAL CO. PYDRAUL—MONSANTO T. M. DIV. OF W. R. GRACE & CO. REG. U. S. PAT. OFF.

New, illustrated booklet gives more details, including how to make the easy conversion to Pydraul AC. Write, today. No salesman will call unless you so request.

Monsanto

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Organic Chemicals Division
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Please send me the new 16-page booklet on fire-resistant Pydraul AC lubricant for air compressors.

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Company_____

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Low Inventory

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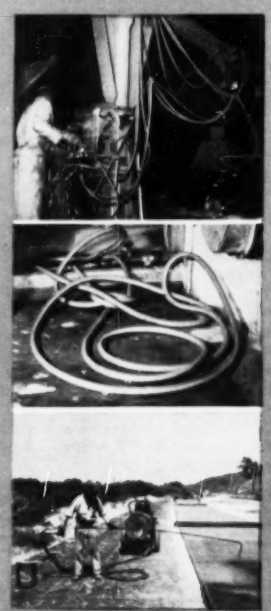
ANOTHER GOODALL *Quality* PRODUCT

Versatility is demonstrated to the Nth degree in this fine hose—built to Goodall's high standards for materials and workmanship.

"ALLSERV" will not only give long, reliable service on air and pneumatic tools, but will prove equally efficient in the handling of water, oil, gasoline, paint and insecticide spraying, grease guns, etc. The adaptability of this one hose to such a wide variety of applications provides a sure way to keep hose inventory *low*.

"ALLSERV" is a very flexible all-"Synplastic"® molded-and-braided hose, in one, two or three braid construction, with a tough wear-resistant red cover. Made in sizes ¼" to 1½" for working pressures from 200 lbs. to 300 lbs.



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lug shank piece is utilized to permit the use of heavier 1¼- or 1⅜-inch hexagonal Type 60 and 70 carburized steel and Type 60 and 70 Carset bits. It also includes a ½-inch, straight-through, air-and-water tube that reportedly provides exceptional hole cleaning, resulting in faster penetration. Designed to be used with the company's FM4 Drill Guide, it can also be applied to self-propelled mountings, such as the Crawl-IR, Wagon Drills, Hydra-Booms and Pipeline Mountings. *Ingersoll-Rand Company*, 11 Broadway, New York 4, N. Y.

SLACKLINE Cableway installations are described in Brochure TC-1. Eight units are discussed, each equipped with torque converters. They haul distances as great as 1000 feet, and dig depths of 90 feet. The booklet also gives typical operating costs for the cableway and contains a layout drawing of a representative installation. *SauermanBros., Inc.*, Dept. C-20, 648 S. Twenty-eighth Avenue, Bellwood, Ill.

SPECIAL type impressions for the field of electronics and electricity are the subject of a booklet published by Remington Rand. It is the first in a series designed to show how any of eighteen different fields can make profitable use of interchangeable typewriter type, whether a standard manual or an electric proportional-spacing typewriter is used. Not only does the method assure clean, neat type for ordinary purposes, but the specialized requirements are consistent as well. In the case of electricity and electronics, many complex symbols, equations and formulas are needed, the characters for which do not exist in convenient form on presently available typewriters. They have to be tediously handwritten, or special type bars must be installed. Both methods are time-

"I forgot to tell you there are some things you can't say to it. It's got a female electronic brain."

consuming and expensive. With the interchangeable type heads, the typist can insert special type characters herself, in a matter of seconds, with one simple operation using special magnetized tweezers. There is no need for an extensive knowledge of typewriter parts or for relearning the keyboard. Only the type face is changed. *Remington Rand Division*, Sperry Rand Corporation, 315 Fourth Avenue, New York 10, N. Y.

A REPEATING hammer, developed primarily for the aircraft and missiles industries to smooth wrinkles in sheet metal, can be utilized wherever sheet metal is planished, peened, crimped, formed, embossed and the like. Called Model 200-RHP-18, the machine is floor mounted and has an 18-inch throat clearance. Pressing a foot pedal brings the hammer cylinder down until the tool is in contact with the work. Valving is internal, and is actuated by contact pressure of the tool against the workpiece. So long as this pressure is maintained, the hammer will repeat at high frequencies, that is, from 1500 to 3000 times per minute, depending on the air pressure. Force of the hammering action is adjusted by regulating the air pressure. The hammer cannot be triggered except by pressure of the tool against the work and is under the operator's control at all times. Tools included with this pneumatic impact machine include a planishing head integral with a shank, and chucks to take standard or special tool shanks. The anvil may be had in special as well as standard shapes and heights.

Heidrich-Nourse Company, 631 E. Third Street, Los Angeles 13, Calif.

APPLICATIONS in which small space and weight and simple installation are important are reportedly suitable for a line of air cylinders that have built-in directional and exhaust speed control valves. Designated as the VIH series, the cylinders are available in 1½-, 2- and 3-inch bore sizes in any stroke length. Directional control valve actuation can be by solenoid, remote pilot pressure, button bleeder, or combination solenoid-button bleeder. Mountings are said to be completely interchangeable. The valves on the cylinders have independent exhaust speed controls with au-

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WHEN BUYING
ANY SPECIALIZED MACHINE:
CHOOSE A MAKE WHOSE BUILDER THINKS ENOUGH OF HIS OWN GOOD NAME TO EQUIP HIS PRODUCT WITH
CONTINENTAL RED SEAL POWER

Photo Courtesy Ingersoll-Rand.

All through the construction industry, you find Continental Red Seal engines building prestige for specific makes of equipment. Within the range of industrial engines alone—15 to 260 horsepower—it would be hard to name a type of engine-driven product—compressor, mixer, pump, earth mover—of which one or more of the leading makes do not rely today on Continental power. Every Continental Red Seal is not only built for the job, but backed by parts and service facilities from coast to coast.

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CLEVELAND VIBRATORS

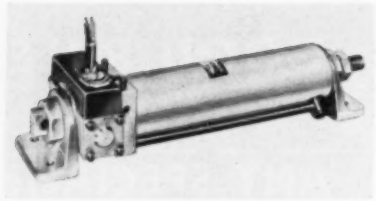
Anyone who stores materials in bins will find a vibrator an economic necessity. Bin vibrators completely overcome plugging and jamming.

The only substitute is a sledge hammer. This involves first, valuable man hours and secondly, expensive bin damage.

A bin vibrator will eliminate these costs. As a result, they will pay for themselves in a very short period of time, actually a matter of weeks.

The Cleveland Vibrator Company offers you complete engineering service on both air and electrically operated vibrators.

If you use bins, chutes, or hoppers you can save valuable dollars, by writing today for complete information and prices on Cleveland Bin Vibrators.



tomatic nylon locks. Threaded exhaust ports permit piping exhaust air for chip blowing, parts ejection and the like. *Modernair Corporation*, 400 Preda Street, San Leandro, Calif.

FILTERS designed for industrial uses are listed in a 2-color, standard-sized bulletin. Liquid, intake and pipeline filters, plus dry and viscous panel varities, the new Duphase, precipitators and electro-Staynew mist collectors are included. In addition, the more recent products to come from the Dollinger research laboratories are shown: a special silencer filter, the standard hydraulic sump filter and a special pipeline filter to handle high-pressure gas. *Dollinger Corporation*, Rochester 3, N. Y.

TO SPEED assembly of reusable Hoze-lok fittings onto industrial rubber- or cotton-covered, wire- or fabric-braided hose, a simple-to-operate machine, Model 422, has been developed. The unit is portable, weighing approximately 160 pounds. It is driven by a ½-hp, 60-cycle electric motor, and can readily handle hose ranging in size from ¼ through 1⅜ inches, i.d. The machine may be mounted on a bench, or lengths of pipe may be used to make legs for it. *Parker Fittings & Hose Division*, Parker-Hannifin Corporation, 17325 Euclid Avenue, Cleveland 12, Ohio.

PRODUCTION, space and cost benefits in continuous distribution of industrial gases by custom-built manifold installations are described in *Industrial Piping Equipment*, a 28-page brochure. Duplex, simplex and portable NCG manifold distribution systems piping oxygen, hydrogen, nitrogen, helium, argon, acetylene and other gases for uses such as welding, cutting, heating, flame hardening, flame blasting and oxygen lance operations are detailed. *National Cylinder Gas Division*, Chemetron Corporation, 840 N. Michigan Avenue, Chicago 11, Ill.

HOSE connections can be repaired quickly and easily by using an O-shaped metal clamp that can be applied with a pair of ordinary pincers. Clamps less than 1¾ inches in diameter have two U-shaped lugs and larger sizes have

ADAMS FACT FILE #2

PLANT AIR

Moisture Chief Cause of Trouble . . .

Every company today is looking for ways to offset the increased costs of labor, material, equipment and services. At a gasoline station you expect "Free Air", but in industry it is a major expense. Perhaps in your own plant, for an investment in a few minor compressed air system alterations, significant savings are possible.

Water, sludge, rust, oil and dirt in compressed air systems are prime causes of maintenance and production down-time. Water vapor condensing in air lines tends to corrode the piping. Also, water present in the piping may freeze during winter, causing serious reduction of compressed air supply. Such restrictions are often difficult to locate and thaw. This same line moisture may emulsify lube oil destroying its lubricating value and the resultant mixture has high fouling characteristics. Frequently, ice will form within the tool itself since expanding air cools the moisture . . . tool efficiency will be seriously affected.

Some of the Other Problems Created By Wet Compressed Air . . .

Wet compressed air is not only a construction and production tool problem. Faulty paint jobs, contaminated chemical and food products can often be traced to moisture laden compressed air. Waterhammer, unequal pipeline thermal expansion and line leaks also result from collected moisture. In addition, air lost through traps, and in blow-down of compressed air lines provide no useful work . . . represent a sizeable power loss.

You Can Lick Compressed Air Moisture Problem . . .

All of these hidden costs can be virtually eliminated by the installation of an Adams Aftercooler and Cyclone Separator between the compressor and receiver tank. By cooling discharge air to within 10° F. of cooling water temperature — guaranteed with Adams standard Aftercoolers — the moisture can be removed at the separator. Pressure loss is less than one-half pound on these units including the separator. In severe cases, moisture removal of over 90 per cent can be obtained by cooling the air with Adams 2° Aftercooler to within 2° F. of water temperature.

Air Filter for Final Protection at Point of Use . . .

As an added safeguard for expensive tools and equipment, an Adams Poro-Stone Air Filter should be installed just before the air is used. These filters remove all solid material picked up by the air stream. With an Adams Aftercooler, Cyclone Separator and Air Filters clean, dry, trouble-free air is supplied to your production tools. You get continuous service with minimum maintenance.

For further information on how the complete line of Adams air equipment can solve your compressed air problems, write today for your free copy of Bulletin No. 712 on Aftercoolers and Bulletin No. 117 on Poro-Stone Air Filters from the R. P. Adams Company, Inc., 209 East Park Drive, Buffalo 17, New York.

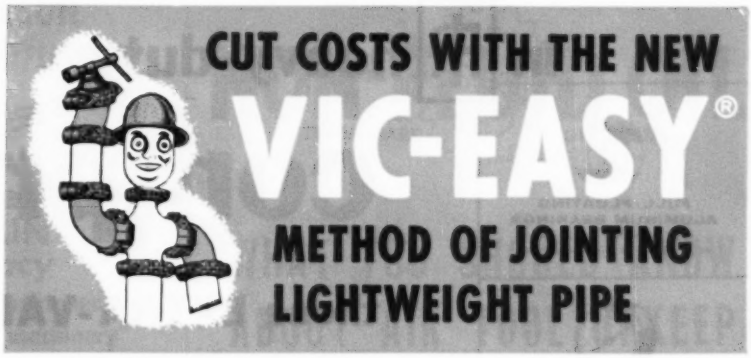
three. Installation is by merely crimping the lugs; removal of clamps from damaged hose is by snipping off lugs with the same pincers used for installation. The devices can be used at many locations on air lines for pneumatic hand tools, air hoists, nut runners, air cylinders and machine tools. The clamps are available in twenty sizes from ¼-inch i.d. to 2⅝-inch i.d. *Circle Clamp Corporation*, 39 Broadway, New York 11, N. Y.

Books...

Instruments For The Study Of Atmospheric Pressure (published by The American Society Of Mechanical Engineers, 29 W. Thirty-ninth Street, New York 18, N. Y.) is a comprehensive listing of devices useful in air pollution investigation and control. It is designed to aid businesses and governments in obtaining suitable equipment for the study of their particular smog problems. Categories include measuring of smoke density samples, particles, gases, vapors and liquids, wind, rain, snow and humidity—all either separately or together. The format of the second edition has been retained. A 10-part outline lists the instruments under general headings. All are individual and range from filter paper samplers to gas chromatographic equipment. The second, main, section amplifies the outline by a complete breakdown of categories. All of these are keyed to the manufacturers' names and addresses, which comprise the third section, and have been brought up to date. Cost, $2.

Blasting Log (published by The Associated General Contractors Of America, 1957 E Street, N. W., Washington 6, D. C.) provides contractors with a permanent record of each blasting operation. In the event of claims resulting from blasts, he can use the log as a reference in connection with any seismographic records that may be available. A unique feature of the AGC booklet is that for the first time it combines all material about blasting operations in one handy form. Each log contains 22 spreads that can be easily separated for use on separate jobs. It also provides a permanent record of the type of formation blasted, depth of holes used for the charges, type and quantity of explosives, number and type of delays, weather conditions under which shots were made, geographic location and time.

The log was devised by the Liaison Committee Of Safety Engineers, a part of the AGC Accident Prevention Committee that gave its approval to the log. Cost: $0.20 each; $2.25 per dozen; and $15 per hundred.



SAVE UP TO 60% IN PIPING COSTS!

Now there's no need to buy overweight pipe. Thanks to Victaulic engineering, you can select lightweight pipe "job-rated" to your conditions and install it the *new VIC-EASY way*. You'll cut costs of pipe, transportation, and handling —you'll save from 30% to 60% in man-hour installation.

1. LIGHTWEIGHT PIPE in thicknesses from .065" handles high pressures. Leading mills make sizes 1¼" to 12", steel or aluminum, with *VIC-EASY roll-grooved ends.*

2. VIC-EASY PORTABLE GROOVER rolls grooves into pipe in seconds. Manually or power-operated, this groover removes no metal...retains full wall thickness.

3. VICTAULIC SNAP-JOINT COUPLING assembles and locks by hand—no wrenches or tools required. Other bolted styles of Victaulic Couplings alternately usable.

4. VICTAULIC FULL-FLOW FITTINGS team up with our couplings and lightweight pipe to provide a *complete VIC-EASY system*...cuts costs of installation *and* operation.

For complete information write for Bulletin BB-4.

VICTAULIC COMPANY OF AMERICA
P.O. BOX 509 • Elizabeth, N. J.

in IR heavy-duty compressors

these EXTRA-VALUE FEATURES mean top performance and economy

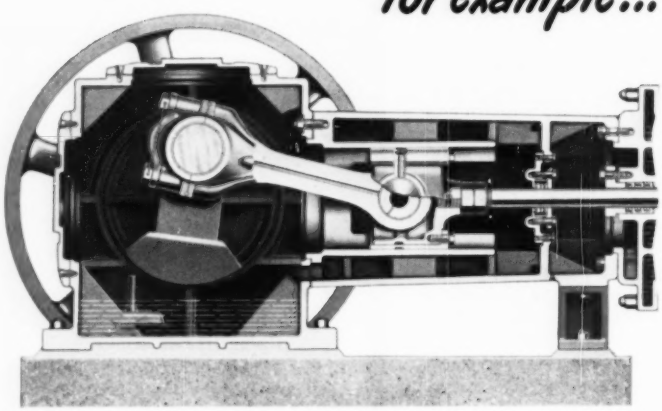
FULL-FLOATING ALUMINUM BEARINGS
Roll with the punch of each stroke to distribute load

FULL FORCE-FEED LUBRICATION
Filtered oil under pressure to all bearing surfaces

SEALED FRAME
Keeps dirt out • Keeps oil in
Keeps wear down

AIR-CUSHIONED CHANNEL VALVES
Highest efficiency • Exceptional durability • Quiet operation

take the SEALED FRAME for example...



dust-tight, oil-tight bolted covers protect all parts; seal never needs to be broken for adjustments

In Ingersoll-Rand compressors, all running parts are protected from dirt and leakage by the tightly-sealed frame construction. There are generous openings for access, of course, but these are sealed by bolted, gasketed covers. Dirt is a major cause of wear in all machinery, and when it is kept out, wear is naturally minimized.

The frame may be kept sealed, since there is no need for internal adjustments. Bearings are the full-floating type which never need adjusting, and the full-floating metallic compressor rod packing adjusts itself! All parts are designed to take years of heavy-duty operation, and repairs or replacements will be rare.

This is only one of the quality features which have earned the Ingersoll-Rand compressor line its reputation for excellence. For more information about compressors of all types and sizes from ½ to 7500 hp, for pressures to 35,000 psi and vacuums, call your I-R representative today.

ESH
20 to 150 hp.

PHE
75 and 100 hp.

XLE
125 to 350 hp.

PRE
400 to 2000 hp.

XPV
(Steam-driven)
200 to 1500 hp.

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COMPRESSORS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS • CONDENSERS • VACUUM EQUIPMENT • ROCK DRILLS

HANKISON CONDENSIFILTERS

REDUCE *maintenance*
MAINTAIN *accuracy*
in pneumatic instruments, controls, and machinery

- **CONDENSE** oil and moisture vapors—for maximum protection of pneumatic systems
- **SEPARATE** entrained liquids—preventing corrosion and sluggish equipment
- **FILTER** contaminant solids—scale, rust, dirt, with disposable cartridge
- **DISCHARGE** all condensates and entrainments with built-in, automatic Mag-Pneu-Power Trap

Capacities: M-100T, 100 scfm at 100 psig; M-30T, 30 scfm at 100 psig. Both models of rugged construction, require only 1 hour per year servicing.

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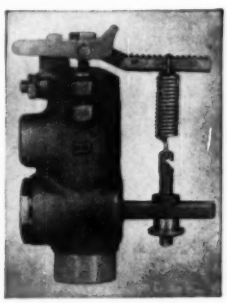
College & Pike Canonsburg, Penna.

24 HOUR SERVICE

Factory Rebuilt

UNLOADER VALVES



any age
any make
any condition

One day is all it takes to change old, worn-out unloader valves into factory rebuilts with new valve guarantee. Conrader exchanges all makes. Cost 1/3 less than new valves.

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R. CONRADER CO. INC.

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NON-FLUID OIL

TRADE MARK REGISTERED

WHAT YOU SHOULD KNOW ABOUT AIR TOOL UPKEEP

Ordinary oil
separates from water

NON-FLUID
is compatible with water

Until the introduction of NR of NON-FLUID OIL, users of all types of pneumatic powered units have fought a losing battle with the moisture content of all compressed air. No regular oil worked with this moisture; it was a constant fight with power and efficiency on the losing side.

NR Grades work on the logical principle, "if you can't lick it join it." Our specially designed and engineered grades for pneumatic service form a permanent emulsion with this airborne moisture, thus eliminating the normally accepted sticking, gumming and rusting.

That's why pneumatic tool manufacturers use and recommend the NR Grades of NON-FLUID OIL for their tools.

Write For Free Testing Sample and Bulletin No. 550.

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"because customers rely on our equipment . . .

we insist on BEARIUM METAL to insure top bearing performance"

For more than a quarter of a century, BEARIUM METAL has been proving its superiority in all types of bearing services. Wherever there is a bearing application involving high speed, poor lubrication, excessive load, elevated temperature, or dust and dirt—or where a liquid other than oil must be used as a lubricant—there BEARIUM METAL will prove its superiority—*conclusively!*

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Non-Seizing and Non-Scoring • Resistant to Shock Loads • High Compressive Strength Self-Lubricating • Low Coefficient of Friction Long-Wearing • Sound, Uniform Structure.

AVAILABLE IN cored and solid bars, centerless ground rods, machined parts, patterns.

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The Pulsation Compensated AIR METER

4 Ranges Covering From 4 to 450 CFM

- SIMPLE AND PRACTICAL OPERATION
- RELIABLE AND DURABLE
- PORTABLE FOR FIELD TESTING
- ACCURACY BETTER THAN 99%

New Jersey Air Meters are accepted everywhere as the most practical, reliable and accurate method of air measurement. With the aid of these meters, you can intelligently select the most suitable equipment for your service, maintain this equipment in effective operating condition, make repairs and adjustments when needed, locate leaks and losses, and scrap the "air eaters" when they become obsolete or worn beyond repair.

These meters show directly on a scale, in cubic feet of free air per minute, the flow of air in a pipe or hose. They measure the air consumption of any pneumatic tool, rock drill, air motor, sand blast, air lift, or other application of compressed air. They permit the control of air flow to any operation or process at the rate that gives the most effective production and highest air economy.

FOR THE COMPLETE STORY, WRITE FOR BULLETIN A-8

NEW JERSEY METER CO., INC.
350 Leland Avenue • Plainfield, New Jersey

Here is the pair for clean, dry air . .

JOHNSON AFTERCOOLER

Used where moisture is vaporized by the heat of compression. Circulates cooling water around the line, condenses the oil and water vapor so Separator can remove them. Simple in design, highly efficient in performance.

SIZES FOR ALL NEEDS

JOHNSON SEPARATOR

Removes more than 99% of all water, dirt and oil from compressed air or steam. Combines the *two* best principles of separation—first allows air to expand slightly, then changes flow direction with the "Thousand Baffles". Model illustrated is the newest idea in separator design, with self-draining trap mechanism built right in.

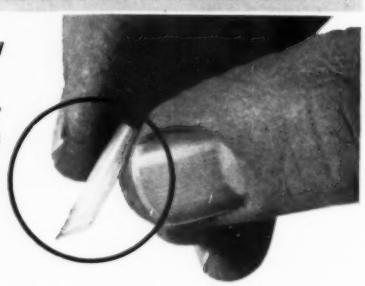
WRITE FOR BULLETIN

The Johnson Corporation
830 Wood Street • Three Rivers, Mich.

ENGINEERING

NEWS YOU CAN USE ABOUT ENGINE AND COMPRESSOR PERFORMANCE

Exclusive New Cook Quill* Assures Better Lubrication of High-Pressure Packings . . .



Oil "dripping" has caused a lot of trouble in high-pressure packings. The surface tension of the heavier oils tended to foul the nozzle. Result: intermittent feeding or none at all. A new Cook-engineered drip nozzle design has solved this problem. Key to the new design is a Teflon quill that extends beyond the cup inner bore and actually *touches* the rod. Thus, oil gradually bleeds onto rod . . . doesn't drop. It maintains a satisfactory oil film on the rod at all times. The quill is now on all Cook steel packings from 4,000 PSI upward. C. Lee Cook Company, 952 S. Eighth Street, Louisville, Kentucky.

*Patent Pending

Rings and Packings Since 1888

C. LEE COOK COMPANY

Division of Dover Corporation

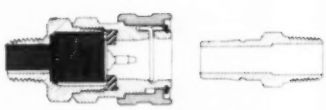
As easy as plugging in your electric shaver...

Wherever you use compressed air...

...just PLUG IN THE POWER

with the **HANSEN** Series RL *QUICK-CONNECTIVE* Ring-Lock Coupling

- Handles more air – with minimum pressure drop.
- Quick connection–and disconnection.
- Instant automatic flow or shut-off.
- Handles any job in your shop using ¾" to ⅛" connections–from the air line to the air tool.
- Locking ring provides positive lock ...tight fit. Equipped with automatic sleeve lock.
- All Series 2-RL Socket and Plugs are interchangeable–likewise all Series 3-RL Sockets and Plugs. Eliminates any need for various size couplings in hook-up – makes it easy to keep stock of parts in balance–holds inventories to a minimum.



Socket, when disconnected, automatically shuts off air by leak-proof seal of metal valve against rubber valve seat.

Write for Hansen Catalog...

a ready reference when you want information on couplings in a hurry.

Quick-Connective Fluid Line Couplings for

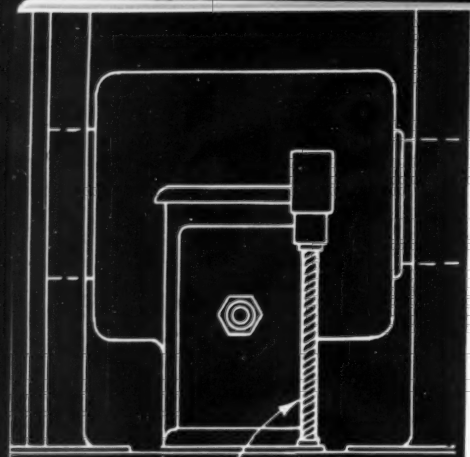
AIR • OIL • GREASE • HYDRAULIC FLUIDS • WATER VACUUM • STEAM • OXYGEN • ACETYLENE • REFRIGERANTS • GASOLINE • COOLANTS • LP-GAS

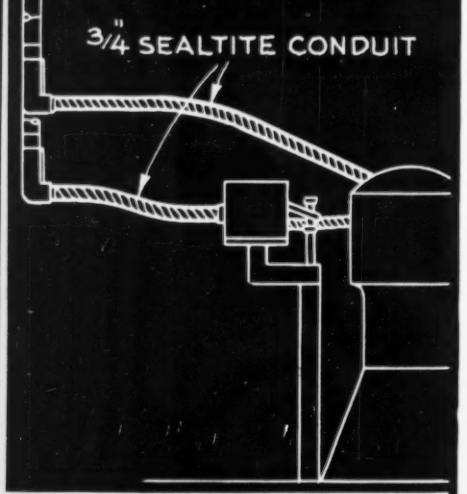
Representatives in Principal Cities

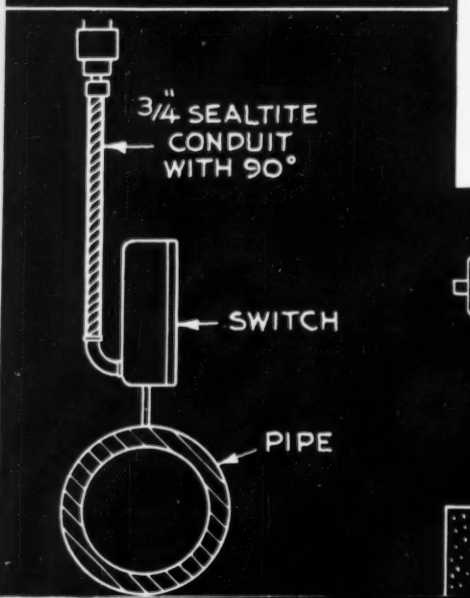
SINCE 1915 — QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 35, OHIO







To carry good engineering over

SEALTITE COMES IN THREE TYPES:

TYPE U.A.— TYPE C.S.A. Specifications for Type U. A. (Underwriters' Laboratories Approved) and Type C. S. A. (Canadian Standards Association Approved). Construction: flexible galvanized steel core, positive ground and tough extruded outer cover.

TRADE SIZE	INSIDE DIAMETER		OUTSIDE DIAMETER		APPR. INSIDE BEND DIAM.	EST. WGT. (Lbs. Per 100 Feet)
(Ins.)	Min.	Max.	Min.	Max.		
3/8	.484	.504	.690	.710	6	30.0
1/2	.622	.642	.820	.840	7	36.6
3/4	.820	.840	1.030	1.050	10	48.2
1	1.041	1.066	1.290	1.315	12	87.7
1 1/4	1.380	1.410	1.630	1.660	15	116.5

TYPE E. F. * is extra flexible—for machine tools and industrial equipment. It meets J.I.C. requirements.

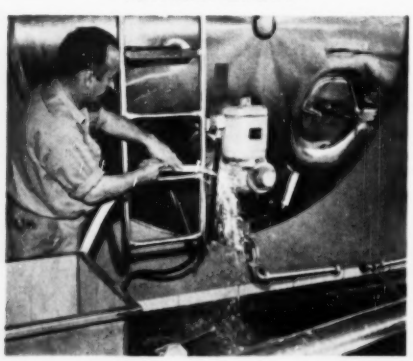
TRADE SIZE	INSIDE DIAMETER		OUTSIDE DIAMETER		APPR. INSIDE BEND DIAM.	EST. WGT. (Lbs. Per 100 Feet)
(Ins.)	Min.	Max.	Min.	Max.		
3/8	.485	.500	.695	.710	5	24
1/2	.620	.635	.825	.840	5	29
3/4	.815	.830	1.035	1.050	6	39
1	1.030	1.050	1.295	1.315	8	67
1 1/4	1.370	1.390	1.635	1.660	10	87
1 1/2	1.575	1.595	1.875	1.900	12	105
2	2.020	2.040	2.350	2.375	15	135
2 1/2	2.480	2.505	2.850	2.875	20	198
3	3.070	3.100	3.470	3.500	26	282
4	4.000	4.040	4.460	4.500	34	414

Commercial tolerances apply on above figures.

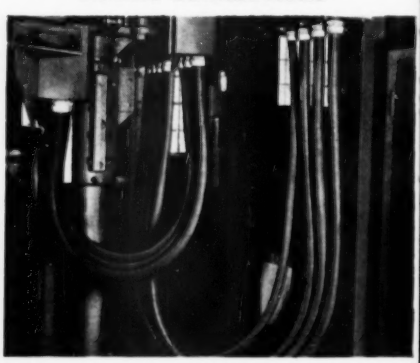
WHERE TO GET SEALTITE — Electrical Wholesalers stock Sealtite with gray or black cover in easy-to-handle cartons or on reels. Be certain you ask for and get the quality conduit marked "Sealtite" on the cover. Buy it in long lengths and cut it on the job without waste. Your wholesaler also stocks liquid-tight connectors.

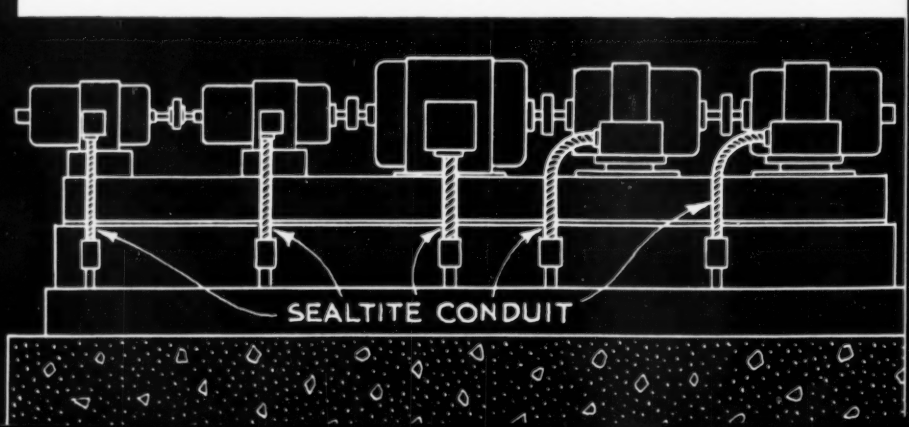
Free Booklet S-539 gives you full information on Sealtite. For your copy, write: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada, Sealtite is approved by Canadian Standards Association, and sold by Anaconda American Brass Ltd., New Toronto, Ont. *Pat. Applied For 58184 Rev.

FOR WET SPOTS



MOVING CONNECTIONS





from plans to performance insist on SEALTITE

the original flexible, liquid-tight electrical conduit that protects wiring against oil, grease, water, dirt, chemicals, corrosive fumes, salt spray, weather.

SEALTITE is a flexible *and* liquid-tight electrical conduit. It gives maximum protection to your wiring when it must connect moving parts, absorb vibration, follow machine contours, flex into U-bends, be easily maintained or be safeguarded between misaligned outlets.

It is being used successfully in wet locations, in tunnels, power plants, steel mills, canneries, chemical plants and in many outdoor applications.

CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl jacket over flexible galvanized steel core. Copper conductor wound spirally inside conduit gives positive ground.

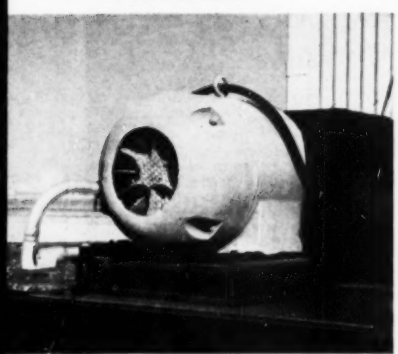
Insist on the conduit marked

SEALTITE®

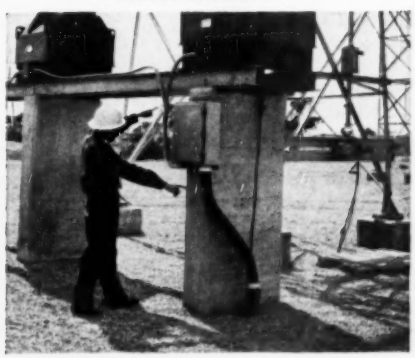
Flexible, Liquid-Tight Conduit

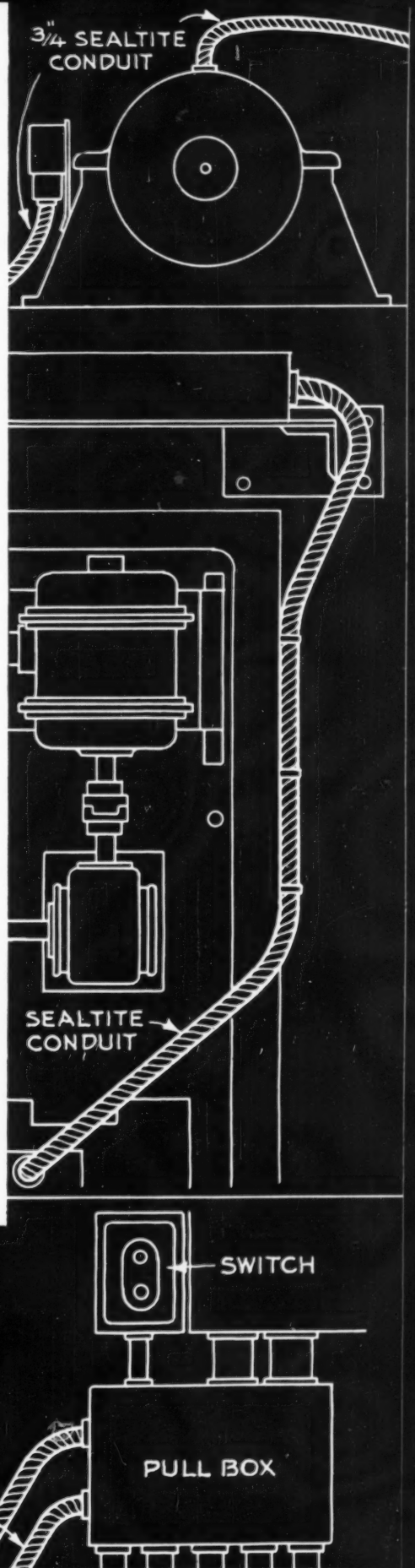
an* ANACONDA® *product

OUTDOORS



MISALIGNMENT





Positive Protection Against Phase Failure and Phase Reversal ?

Here is your answer!

The Allen-Bradley Bulletin 812 Type F, Type R, and Type RF relays provide positive protection against the hazards to men, motors, and driven machinery, resulting from phase failure and/or phase reversals.

The Bulletin 812 Style F phase failure relay employs a unique static sensing network that responds to all open phase conditions on a motor branch circuit and immediately removes the motor from the line . . . irrespective of the load on the motor (including no load), or the circuit arrangement. This relay even responds to hard-to-detect primary failures on a wye-delta transformer with ungrounded neutral. Furthermore, the five-cycle response prevents nuisance "drop-outs" from transient fluctuations.

The Bulletin 812 Style R phase reversal relay disconnects the motor from the line—whether it is running or not—when a phase reversal occurs anywhere in the system on the line side of the relay. Thus, it can be employed for a single motor, a group of motors, or an entire power system. In addition, the phase reversal relay prevents the motor from starting should phase failure occur while at a standstill—a vital feature for elevator applications.

The Bulletin 812 Style RF relay combines the elements of Style R and Style F relays for protection against both phase failure and phase reversal. All Bulletin 812 relays are inherently "fail safe." Send for complete information.

Allen-Bradley Co., 212 W. Greenfield Ave.
Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd.
Galt, Ont.

A-B

ALLEN-BRADLEY

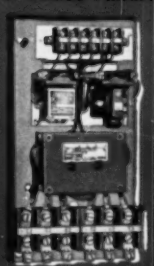
QUALITY

MOTOR CONTROL

Bulletin 812, Style RF for Phase Failure and Phase Reversal

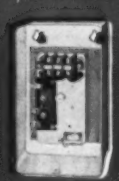
INDIVIDUAL RELAY UNITS AVAILABLE

For Phase Failure



Style F covers full load currents from 1.5 to 300 amp in 4 sizes. Coils for up to 600 v, 60 cycles.

For Phase Reversal



Style R made with coils for 110, 208/220, 440, 550 v for either 50 or 60 cycle operation.

4 YEARS CONTINUOUS OPERATION

George AUTOMATIC Ejector Eliminates Air Compressor Drainage Problems

The Automatic Ejector on the Compressor in the picture has given over four years of satisfactory service to date.

The George Ejector operates automatically every time the compressor starts and stops. It maintains a clean dry tank without any attention.

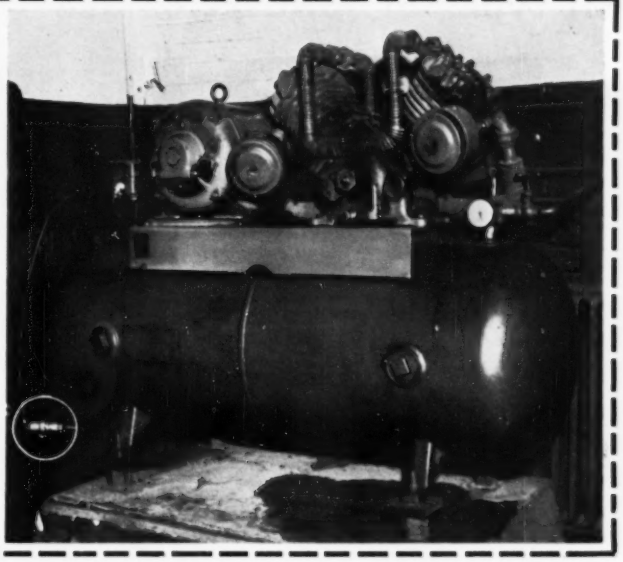
Mechanical design is rugged and simple . . . easily applied . . . inexpensive.

The ejector has a NYLON spindle for long wear.

Specify George Ejectors on your next compressor order.

Fill out card and mail today for Free Literature

GEORGE MANUFACTURING CO.
10-16 Harvey Street,
Philadelphia 44, Pa.



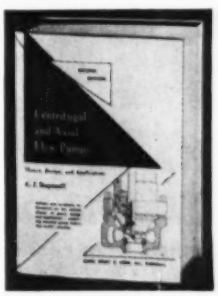
Complete information on pump design and application . . .
NEW SECOND EDITION

CENTRIFUGAL AND AXIAL FLOW PUMPS

By A.J. Stepanoff, Ingersoll-Rand Company, Development Engineer

Keeps pace with progress . . .
Revised and expanded to reflect the significant advances in recent years in the field of centrifugal pumps, this book provides a modern treatment of the whole field. Includes a method of attack based on: a single pattern of flow; identical theoretical reasoning; and similar design procedure for centrifugal, mixed flow, and axial flow pumps.

Features of the 2nd edition . . .
- New material on centrifugal-jet pump systems
- Important design elements and performance characteristics incorporated in a single chart covering all important design elements
- Chapter on water-hammer problems
- A Concise account of progress in water storage pumps
- New charts relating to impeller design for any discharge angle
- . . . and many others



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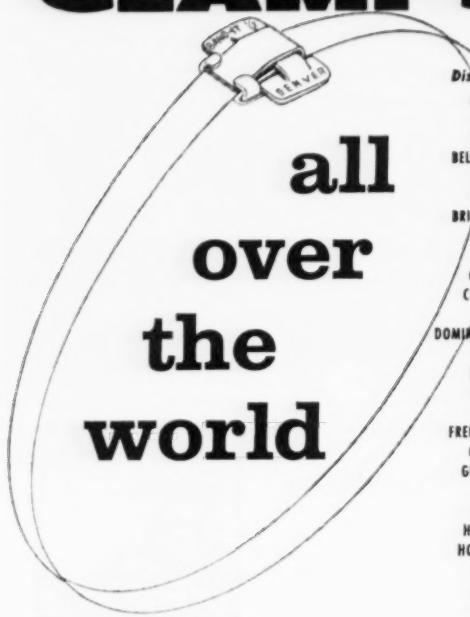
all types of industries use

BAND-IT. CLAMPS



all over the world

Clamps of all diameters formed from continuous roll of stainless steel band without waste . . . for a few cents and in a few seconds.

THE BAND-IT CLAMP WAREHOUSE

Holds 900 BAND-IT industrial pressure clamps in approximately 1 cubic foot of space.

Carry BAND-IT tool, band and buckles (all that is needed to form Band-It clamps) in this portable Clamp Warehouse, just like a tool kit. Makes 900 stainless steel clamps of all diameters—for any type clamping job, any shape of object. Especially useful for emergencies such as leaking pipe or hose. 1001 other uses.

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Over 1500 Authorized Distributors in all principal cities of the United States and in 59 other countries.

BAND-IT CO.

Incorporated 1937

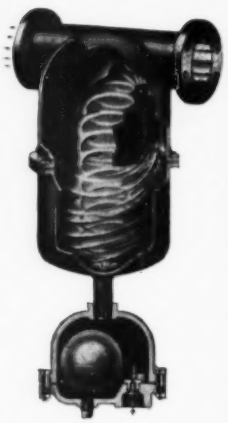
4765 Dahlia St., Denver 16, Colorado, U.S.A.

BAND IT CLAMPS GO AROUND THE WORLD

New Design Assures Maximum Entrainment Removal With Low Cost "T" Separator

Redesigned annular passage increases centrifugal force. Separated moisture, oil and solids travel outer wall to lower collecting chamber. Large diameter, high level outlet reduces velocity, eliminates entrainment problems. Screwed ends ½" thru 3". 125 lbs. flanged ends 2½" thru 8". Low cost in-line installation.

Combined with No. 90AC automatic drain trap to prevent loss of steam, air or gas provides most efficient and economical separator-drain combination available.

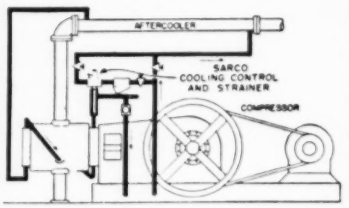


WRITE FOR BULLETIN TB-541-B

WRIGHT-AUSTIN COMPANY

3245 WIGHT STREET • DETROIT 7, MICH.

Sarco Self-Powered Cooling Control



Typical Applications
Compressors, small engines, water-cooled bearings, condensers, dry cleaning stills, etc.

Inexpensive

COOLING CONTROL

½" size—only about $37

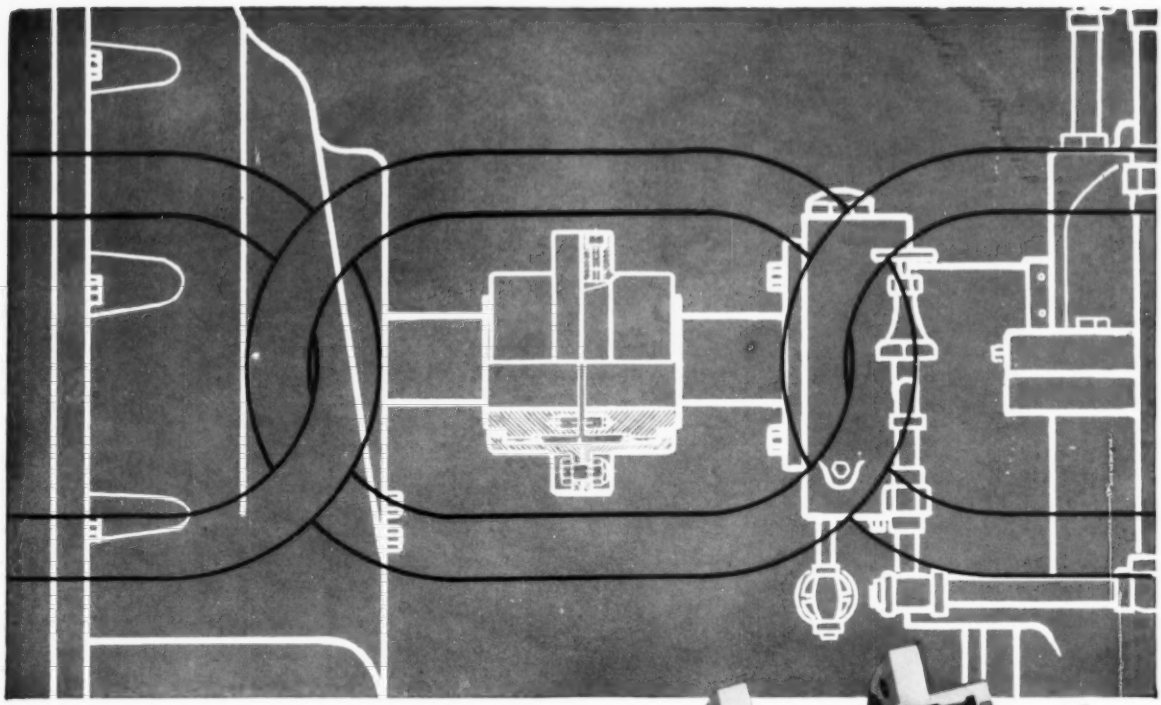
Simple, compact automatic thermostatic valve. Eliminates overcooling and undercooling. Saves water . . . and replaces guess-work with certainty.

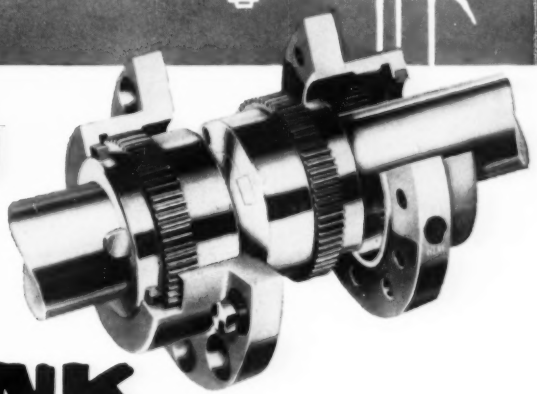
1. Self-powered . . . requires no compressed air or electricity.
2. Self-contained . . . no exposed mechanism.
3. Packless valve . . . single-seated . . . unaffected by silt or scale-forming minerals.
4. Compact . . . ½" size only 3¼" wide, 15" high.
5. Easy to install by any pipefitter.
6. Thousands provide dependable service for firms such as Ingersoll-Rand, Butler Mfg. Co., Swift & Co.

Write for Bulletin 710 to Sarco Company, Inc., Empire State Bldg., New York 1, N.Y.

2240-F

SARCO





FOR WELL-DESIGNED EQUIPMENT...

SPECIFY THIS

POWER LINK

When a lot of time and effort have gone into the design of a piece of driven equipment, it makes sense to pick the power link carefully. Take a pump or compressor, for instance. No matter how well it is designed and built, for long service life and operating efficiency, it needs protection against strains due to misalignment.

Waldron gear couplings provide complete protection and positive, trouble-free drive because

They are strong . . . Hubs and cover sleeves for sizes 1¼A through 7A are machined from tough steel forgings. Hubs are keyed to the shafts. The two one-piece cover sleeves function as a single, rigid unit serving as a floating connecting link between the hubs. High strength of forgings makes possible a very compact coupling with low rotating inertia.

They are reliable . . . There are no flexible parts to bend or break and the coupling is dust, moisture, and oil tight. Patented Walflex seal is at the lowest possible diameter where centrifugal force is least. Clearance between teeth in hubs and sleeve is engineered so that an oil wedge always separates them, taking the wear.

They are available . . . Plenty of rough bore couplings, already assembled—on the shelf for *immediate* delivery. Finish bored standard couplings shipped to meet customers' schedules. We are geared up to give you realistic delivery on *any* type of couplings.

Ask for Catalog 57

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JOHN **WALDRON** CORP.

Subsidiary of Midland-Ross Corporation

NEW BRUNSWICK, NEW JERSEY

Representatives In Principal Cities ● *Export Agents—Frazar & Co., New York, N. Y.*

More than 477,000 horsepower of

CENTRIFUGAL COMPRESSORS

for NATURAL GAS SERVICE

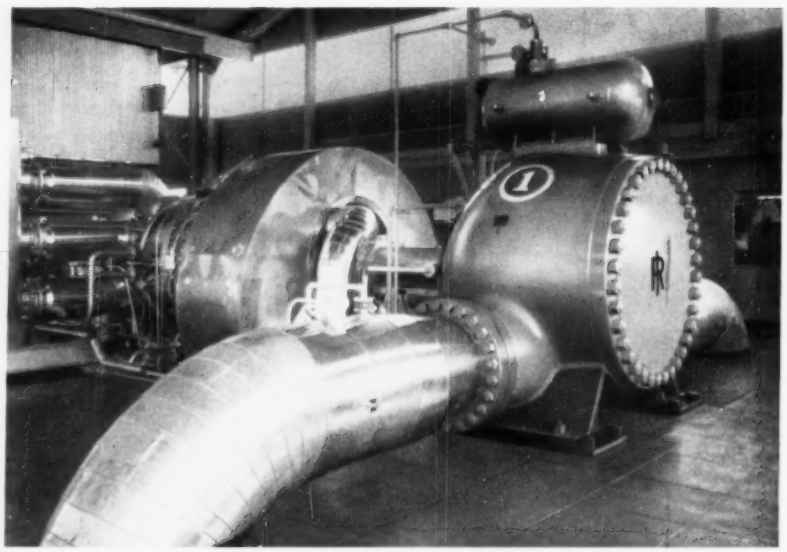
I-R *"FIRSTS"* in Centrifugal Gas Compressor History

FIRST CENTRIFUGAL PIPE-LINE COMPRESSOR Built by Ingersoll-Rand in 1931, this centrifugal pipe-line booster consists of a six-stage compressor driven by a 3550 rpm, 3000 hp motor, all encased in a pressure vessel.

FIRST COMMERCIAL APPLICATION of centrifugal pipe-line compressors was made in 1947. A total of 78 electric-motor-driven, single-stage I-R centrifugals were installed, to handle approximately 250 mmcfd.

FIRST GAS-TURBINE-DRIVEN UNIT Installed in 1949, this Ingersoll-Rand centrifugal compressor, powered by an 1850 hp simple cycle combustion gas turbine, was the first gas-turbine-driven centrifugal compressor developed and applied to pipe-line service, and was designed for a flow of 192 mmcfd at a ratio of 1.18.

FIRST 2000 PSI CENTRIFUGAL GAS COMPRESSOR This Ingersoll-Rand 5000 hp double-case centrifugal compressor was the first unit ever built for handling natural gas at a discharge pressure of 2000 psi.



One of 12 Ingersoll-Rand centrifugal compressors on a large natural gas pipe-line.

This experience means MAXIMUM DEPENDABILITY in modern pipe-line service

FROM the very first pipe-line installation, Ingersoll-Rand has pioneered in the development of centrifugal gas compressors for higher and higher capacities and pressures. And every step of the way, dependability of performance has been a prime consideration in every detail of design and construction. This is why more I-R Centrifugal Compressors have been sold for natural gas service than any other make . . . . a total exceeding 477,000 hp for this service alone.

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